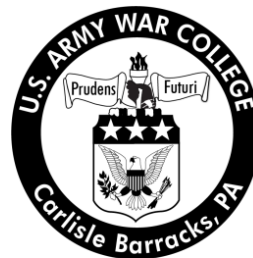


Civilian Research Project USAWC Fellow

Obesity: A United States Strategic Imperative

by

Colonel George N. Appenzeller
United States Army



United States Army War College
Class of 2013

DISTRIBUTION STATEMENT: A

Approved for Public Release
Distribution is Unlimited

This manuscript is submitted in partial fulfillment of the requirements of the U.S. Army War College Fellowship. The views expressed in this student academic research paper are those of the author and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</p>					
1. REPORT DATE (DD-MM-YYYY) xx-04-2013		2. REPORT TYPE CIVILIAN RESEARCH PROJECT		3. DATES COVERED (From - To)	
4. TITLE AND SUBTITLE Obesity: A United States Strategic Imperative				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Colonel George N. Appenzeller United States Army				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Ms. Karen Malebranche United States Department of Veterans Affairs				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Dr. Thomas Williams U.S. Army War College, 122 Forbes Avenue, Carlisle, PA 17013				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Distribution A: Approved for Public Release. Distribution is Unlimited.					
13. SUPPLEMENTARY NOTES Word Count: 12,873					
14. ABSTRACT <p>The prevalence of obesity within the United States is widely recognized as a leading cause of death, chronic disease and health care costs. In 2010, 35.7% of adults and 16.9% of children were obese, approximately 90 million Americans. The American Heart Association estimates medical costs from obesity in 2030 will be 861-957 billion dollars, or 16-18% of the United States health budget. However, this only scratches the surface of the total economic and strategic impact. The military, while predominantly affected in recruitment and retention, sees clear impacts on readiness, power projection, manpower utilization and resource allocation that will become increasingly important as budgets continue to decline. This manuscript reviews the effects of the growing problem of obesity in the United States and its impact on the military, Veteran and civilian populations, as well as, obesity's effect on the military, economic and diplomatic elements of national power. The imperative for and the benefits of addressing this epidemic are discussed, along with current programs and planning efforts. It concludes with recommendations for military, Veterans Affairs and civilian policy makers.</p>					
15. SUBJECT TERMS Readiness, Budget, Health Care, Disability, Environment, Economics					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 72	19a. NAME OF RESPONSIBLE PERSON
a. REPORT UU	b. ABSTRACT UU	c. THIS PAGE UU			19b. TELEPHONE NUMBER (Include area code)

USAWC CIVILIAN RESEARCH PROJECT

Obesity: A United States Strategic Imperative

by

Colonel George N. Appenzeller
United States Army

Ms. Karen Malebranche
United States Department of Veterans Affairs
Project Adviser

Dr. Thomas Williams
U.S. Army War College Faculty Mentor

This manuscript is submitted in partial fulfillment of the requirements of the U.S. Army War College Fellowship. The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

The views expressed in this student academic research paper are those of the author and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

Abstract

Title: Obesity: A United States Strategic Imperative

Report Date: April 2013

Page Count: 72

Word Count: 12,873

Key Terms: Readiness, Budget, Health Care, Disability, Environment, Economics

Classification: Unclassified

The prevalence of obesity within the United States is widely recognized as a leading cause of death, chronic disease and health care costs. In 2010, 35.7% of adults and 16.9% of children were obese, approximately 90 million Americans. The American Heart Association estimates medical costs from obesity in 2030 will be 861-957 billion dollars, or 16-18% of the United States health budget. However, this only scratches the surface of the total economic and strategic impact. The military, while predominantly affected in recruitment and retention, sees clear impacts on readiness, power projection, manpower utilization and resource allocation that will become increasingly important as budgets continue to decline. This manuscript reviews the effects of the growing problem of obesity in the United States and its impact on the military, Veteran and civilian populations, as well as, obesity's effect on the military, economic and diplomatic elements of national power. The imperative for and the benefits of addressing this epidemic are discussed, along with current programs and planning efforts. It concludes with recommendations for military, Veterans Affairs and civilian policy makers.

Obesity: A United States Strategic Imperative

Obesity has been long recognized as a worsening problem within the American population. There continues to be growing concern about the effects of the increasing weight of Americans. At the root, obesity has been recognized as a leading cause of diabetes, heart disease, stroke, multiple cancers, sleep apnea, and osteoarthritis, among others. These disorders underlay the vast majority of the impacts of obesity which presents a significant strategic issue stretching across all the elements of national power.

Approximately 90 million Americans are obese¹, accounting for more than 20% of the world's obese population². More concerning is that the United States obesity rate has grown from 13% in 1960³ to 35% in 2010⁴ and overweight from 31.5%⁵ to 69%.⁶ While the growth rate has slowed over the last three years, the trend does not seem likely to reverse, as one in three children age 2-19 are overweight and one in six obese⁷, five times the rate in 1973.⁸ If current trends persist, it is estimated that up to 90% of Americans will become overweight or obese by 2030, with more than 50% categorized as obese.⁹

The military is not immune to this and from 1998-2010 the number of active duty service members with a diagnosis of overweight or obesity more than tripled.¹⁰ In January 2011 Medical Monthly Surveillance reported that 6.5% of Army service members were overweight or obese compared to 2.3% in 1998.¹¹ This data likely significantly under-represents the prevalence. First, the rate was determined by extrapolating diagnoses of obesity from medical appointments and utilizing Army end strength to determine the rate. This method misses many Soldiers who had care outside of the military direct care system and those for whom the specific diagnosis was not

given in the medical coding portion of the medical record. Despite this, the trend itself is alarming. Further, June 2012 data from Public Health Command shows that 48.8% of active duty Army patients seeking medical care were overweight and 20.4% were obese by body mass index (BMI) calculations, which is nearly identical to the data from June of 2009 (48.1 and 20.2%).¹² More concerning is a 2003 report which found the prevalence of self-reported overweight in military active duty service members to be 57% while the obesity rate was 9%.¹³ The Department of Veterans Affairs (VA) is seeing even higher rates of overweight and obese Veterans with more than 70% of Veterans who seek health care from the VA being overweight and 33% being obese.¹⁴

Economic Impact of Obesity

The most obvious element of US national power impacted by obesity is economic. Obesity directly leads to multiple medical problems and the direct cost of caring for obese individuals is 30-42% higher than those with a normal weight.¹⁵ This direct medical care currently accounts for up to 6-9% of the US healthcare budget¹⁶ and 27% of the growth in annual healthcare expenditures.¹⁷ Obesity currently accounts for 46-147 billion in direct medical care costs.¹⁸ If current trends continue, estimates of healthcare costs attributable to obesity range from 861-957 billion dollars by 2030¹⁹ and 16-18% of US healthcare expenditures,²⁰ as well as, a 22% reduction in life expectancy.²¹ According to Peter Orszag, in testimony before the U.S. House of Representatives Budget committee on December 13, 2007, the rate of health care cost growth will be the major determinant of federal spending.²² Before the Senate committee on the Budget on June 21, 2007 he stated that “rising health care costs and

their consequences for federal health insurance programs constitute the nation's central fiscal challenge."²³

Obese patients utilize 27% more physician visits, expend 80% more on prescription drugs and incur 46% higher inpatient medical costs.²⁴ The Patient Administration Systems Biostatistics Activity (PASBA) estimates that in the military obese individuals utilize up to 34% more direct care appointments than normal weight individuals.²⁵ While national costs are estimated at upwards of 147 billion dollars²⁶, the total cost is difficult to estimate, as multiple medical diseases are all inter-related and spending crosses over. For example, obesity is the greatest contributor to the development of diabetes which in 2005 had annual direct cost of approximately 27 billion.²⁷ However, when the diabetic contribution to multiple other diseases was accounted for the cost rose to more than 190 billion dollars.²⁸ Similarly, obesity contributes to diabetes (\$27 billion), stroke (\$27 billion), heart disease (\$123 billion), hyperlipidemia (\$23 billion), high blood pressure (\$50 billion), musculoskeletal disorders (\$121 billion), and multiple cancers (\$20 billion) among others.²⁹ The percentage of the medical costs of these conditions that is directly and indirectly caused by obesity is impossible to precisely determine. However, it is clear that obesity is one of the main drivers of medical conditions that cost nearly 400 billion dollars in 2005 and have continued to increase. Any estimate of direct medical expenditures likely underestimates the impact.

The economic burden of obesity goes well beyond the direct medical costs. The indirect costs in lost productivity, compensation and lost disability free years is estimated to be more than 208 billion dollars each year, with estimates as high as 580

billion dollars.³⁰ Estimates of lost productivity due to absenteeism alone, related to obesity, ranged from 3.4 to more than 6 billion dollars in 2008³¹ with an overall loss of 1.7-3 million person years accounting for an additional estimated 390-580 billion dollars lost.³²

At a national level, federal spending for healthcare is estimated to be roughly equivalent to the federal budget for Defense, at 22% and 24% respectively, and it is estimated that each will comprise approximately 24% of the FY13 budget.³³ More concerning is that when national expenditures are viewed as a portion of the United States Gross Domestic Product (GDP), healthcare dwarfs the overall Department of Defense budget constituting 17% of spending³⁴ vs. 4.7% spent on National Defense in 2011.³⁵ However, even within the defense budget, the Department of Defense (DoD) spends an additional 52 billion or 9% of the DoD budget on healthcare.³⁶ In 2007, TRICARE spent approximately 1.1 billion dollars on obesity.³⁷ It is estimated that in 2007 there were 658,000 lost FTE workdays to absenteeism in overweight and obese active duty service members. An additional 17,000 FTE work days were lost to decreased performance levels while present for duty, often called presenteeism. This represents a loss to the DoD of 103 million dollars in absenteeism and 2.6 million in presenteeism.³⁸

The VA has not only seen an increase in obesity, but growing numbers of veterans with related medical conditions. Between 2000 and 2008 the rate of diabetes increased by 34%, hypertension by 25%, stroke by 51% and arthritis by 6%.³⁹ While overall VA spending on obesity and obesity related diseases is difficult to obtain, combined costs of hypertension, diabetes, heart disease and stroke was 7.95 billion

dollars in 2008.⁴⁰ Arthritis treatment, to which obesity contributes and exacerbates, contributed an additional 881 million dollars in expenditures.⁴¹

Military Impacts of Obesity

Beyond the purely fiscal risks posed by obesity, force readiness and projection are severely impacted. Medical appointments are a finite resource with 8,139,851 primary care appointments utilized in 2012.⁴² Additionally, there were 852,789 Emergency Department visits, 224,094 cardiology visits, 33,905 endocrine visits, 66,442 oncology visits and 152,561 neurology visits. There were an additional 132,830 nutrition care visits. While musculoskeletal utilization is more difficult to obtain, there were 1,767,731 visits between physical medicine, orthopedics and physical therapy. This data does not include admissions and operations.⁴³ Defining exactly how many of these appointments are secondary to obesity issues is difficult; however, even using a conservative 6% estimate⁴⁴ based on overall health care expenditures, obesity related illnesses take up more than 488,000 primary care appointments each year, and likely a much higher percentage of endocrine and cardiology appointments. At a higher 9% estimate,⁴⁵ this approaches 734,000 appointments. Utilizing the outpatient utilization rates that PASBA found, in which obese individuals utilized 34% more appointments and overweight individuals utilized 28% more appointments⁴⁶ this number approaches 900,000. Additionally, PASBA estimates that there were 49,351 direct care inpatient admissions in FY12 for obese and overweight patients.⁴⁷ This represents 73.4% of admissions in which the weight is known. Though it is difficult to determine what percentage of this is directly or indirectly the result of obesity, obese individuals are admitted at a rate 1.9 times higher than normal weight individuals to military treatment

facilities.⁴⁸ This outpatient and inpatient care directly, regardless of causative etiology, translates into less available medical resources to combat units, deployment processing and prevention efforts.

Furthermore, there is an association between obesity and depression⁴⁹ and it has been demonstrated that treatment of obesity can lead to a decrease in depression.⁵⁰ Conversely, pharmacologic treatment of depression may actually worsen obesity.⁵¹ Additionally, it has been demonstrated that those with increasing body mass index have increasing levels of suicidal ideation, though several studies show a lower risk for completed suicide.⁵² Additionally, Lin, et al. found that 42% of patients seeking obesity treatment had at least one psychiatric disorder, predominantly mood and anxiety disorders.⁵³ Causal relationships have not been demonstrated, however, it is known that stress and other genetic factors play a role in both.⁵⁴ Ultimately, it does appear that increased obesity levels within the force may lead to increased utilization of very scarce behavioral health resources, and may be alleviated by prevention of obesity. It should also be considered if increasing obesity levels may be a marker for stress, anxiety and other mental health issues within the force.

From a National Defense perspective, the effects of high medical utilization by individuals with increased weight are compounded by the loss of combat power due to those medical conditions. While not a direct military study, within civilian populations it was shown by Roos et al. that overweight males had a musculoskeletal related disability retirement rate 5.6 times more than normal weight males.⁵⁵ Females had a rate 11 times higher for musculoskeletal disorders and 2.7 times higher for mental health disorders.⁵⁶ All cause disability retirement rates were increased by 1.42 times for

overweight, 1.98 times for obese and 3.45 times for severely obese compared to normal weight populations.⁵⁷

Obesity related conditions often result not only in disability retirements, but also in non-deployable conditions (Diabetes and Obstructive Sleep Apnea restrictions in CENTCOM for example⁵⁸), as well as, elevated disease and non-battle Injury rates both at home station and in theater.⁵⁹ Between 2005 and 2010 there were between 13,536 and 16,255 Disability Evaluation System (DES) evaluations each year for a total of 88,327 evaluations.⁶⁰ In 2010 6.8% of enlisted members entering DES had a diagnosis at their military entrance physical of overweight or obesity, up from the historical average of 5.8%.⁶¹ Further, 9.3% of enlisted service members entering DES in 2010 had an objective medical finding of either weight or body fat percentage abnormality at their military entrance processing (MEPS) physical.⁶² While those categorized as overweight were only slightly more likely than their normal weight peers to receive a 30% or more disability retirement, those classified as obese had a 40% higher likelihood.⁶³ As of February 12, 2013 there were 26,612 Soldiers in the DES process and 8,366 with cases longer than 400 days.⁶⁴ If a very conservative number of 6.5% (the lowest published rate of obesity in the Army)⁶⁵ is used as the percentage of claims that may have a relationship to or exacerbated by an overweight status it represents a combat power drain equivalent of more than 1,700 Soldiers. A worst case scenario utilizing 48.8% (the June, 2012 Public Health Command Data for those seeking medical care)⁶⁶ this drain becomes almost 13,000 Soldiers, more than two brigade combat teams. If the pre-board profiling phase of up to one year plus the goal of 295 days⁶⁷ for board processing is used, this represents between 3,000 and 23,000 lost Soldier years

to the deployable operational force. If the current average processing of 430 days⁶⁸ is used this jumps to between 3,700 and 28,000 Soldier-years.⁶⁹ This represents a very large range of possibility, but given that in 2010, more than 40% of conditions evaluated for disability were those considered related to or exacerbated by overweight and obesity⁷⁰ these estimations are plausible. The lost Soldier work-years are somewhat mitigated by the amount of useful non-deployable work that can be attributed to this cohort, but overall this causes not only a short term readiness issue, but long term financial impacts ranging from the cost of training a replacement to medical disability care and pensions.

Additional to this are the 1808 enlisted Soldiers that were chaptered for failure to meet height and weight standards after enrollment in the Army Weight Control Program in 2012, according to the Defense Manpower Data Center.⁷¹ This data does not include those service members who did not receive a chapter discharge, but may be overweight at separation for other reasons. Financially, Accession Medical Standards Analysis and Research Activity estimate that recruiting, screening and training an enlistee costs approximately 75,000 dollars.⁷² This represents a loss of 135 million dollars in replacement personnel, beyond the lost knowledge, skills and immediately available personnel. The addition of between 1,700 and 13,000 Soldiers medically discharged for obesity related injury and illness⁷³ drives this number to between 127 to 975 million dollars potentially lost. Further compounding the issue, Soldiers with obesity are up to 1.5 times more likely to be discharged from service in the first year after accession than their normal weight peers.⁷⁴ In an additional study, 21% of first term Soldiers enrolled in the Army Weight Control Program were discharged within 15 months of accession.⁷⁵

Replacing these lost Soldiers, as well as, those lost to retirement and natural attrition may also become problematic if current trends continue. According to Dr. Curtis Gilroy, Director for Accession Policy, in testimony before the House Armed Services Personnel Subcommittee on March 3, 2009, 35% of American youth ages 17-24 are ineligible to serve for medical reasons, with obesity as the primary factor.⁷⁶ This is compounded by additional reasons young Americans may not be able to serve (alcohol and drugs, criminal behavior, low aptitude, college) leaving only 15% of the population eligible for service, which rises to 25% if you include those in college.⁷⁷ However, when looking at the available high school diploma graduate group which the DoD is expected to fill 90% of allocations with, the pool drops to approximately 5% of youths 17-24.⁷⁸ The Army is currently meeting its recruiting goals with high quality recruits, and given the national economic situation and a downsizing personnel posture, this low recruiting pool size will have little short term impact. However, should there be a situation requiring a large standing military this could become a significant issue, particularly given that the civilian industrial, scientific and leadership base pulls from this same recruiting base.

Other National and Global Impacts.

While Obesity is the marker for disease, it is not necessarily the driving issue, but the result of an underlying process of increased consumption. According to the Centers for Disease Control, the average American male consumed 2618 calories per day and females 1877 calories in 2000, up 22% from 1970 levels.⁷⁹ However, the USDA estimated the average daily consumption in 2000 was approximately 2700 calories per person per day, an increase of 24.5%, more than 500 calories per day since 1970.⁸⁰

Concurrently, activity has decreased with less than half of Americans meeting recommended minimum physical activity guidelines.⁸¹ This has led to the average American weighing 25 pounds more than in 1960 with an average of 3% increase in BMI.⁸² According to a 2011 Gallup poll, American's self reported weight was up by more than 20 pounds since 1990 with the average male and female weighing 196 and 160 pounds, respectively.⁸³ With a US population of approximately 309 million,⁸⁴ these estimates equate to more than 154.5 billion more calories per day consumed in the United States and Americans weighing 6.18 billion additional pounds. In terms of agricultural output, this is the equivalent of the calories in 100 million pounds of whole wheat flour, 363 million pounds of corn or 125 million pounds of ground beef each day.⁸⁵

American eating patterns have also changed over time. From 1950 to 2000 the amount of meat eaten per American has increased by 57 pounds per year (poultry representing 46 pounds).⁸⁶ Surprisingly however, the percentage of calories from meat decreased from 33% to 24%.⁸⁷ Additional calories are also provided by a 20% increase in cooking oils, a 23% increase in fruits and vegetables and an overall increase of calories from added fat of 17% since 1970.⁸⁸ Most concerning, however, is the 62 pound per year increase in cereals and grains consumed by the average American, predominantly in refined grains, not whole grains. This is compounded by 152 pounds of sweeteners (sugar and high fructose corn syrup) or 32 teaspoons of additive sugars per day with 22% of that coming from carbonated beverages.⁸⁹ Overall, the United States average available food supply is 3,688 calories per person per day.⁹⁰ In comparison the world's poorest countries have 2300 calories or less available per person per day.⁹¹

To support our food markets, in 2002 the US farmed 442 million acres of land, 340 million for crops and 62 million for pasture with the remainder either laying idle, not harvested or seeded to soil improvement crops.⁹² In 2007 the reported acreage dropped to 408 million acres, however, 26 million acres of that was only a change in categorization of pasture lands, yielding a comparative result of 432 million acres.⁹³ Overall, in 2011 the US produced 49,231.6 million pounds of red meat and 43,635.5 million pounds of poultry,⁹⁴ with a net export of only 14,000 million pounds per year, leaving 78, 867 million pounds of meat within the US, excluding fish and shellfish.⁹⁵ This level of production leads to the emission of 7% of the US production of greenhouse gases, and a growth of 13% since 1990, predominantly from livestock waste management systems.⁹⁶ Overall, emissions reached more than 520 million metric tons in 2010 with a fairly even split between production from livestock and agricultural soil management.⁹⁷ Compounding the issue is the inactive lifestyle that leads to obesity increasing the predominance of greenhouse gas emitting behaviors. Approximately 50% of all car travel is less than 5 miles in distance, with 9.4% less than one mile.⁹⁸ Only 12.7% of children walk or bike to school.⁹⁹ Combined with more than 50% of the population¹⁰⁰ partaking in indoor, sedentary lifestyles, increased internet usage and other power consuming activities (air conditioning), there is a direct impact on the 27% of emissions from transportation and the 34% from electricity production.¹⁰¹ In 1978, it was estimated that beyond just the resources expended on moving the extra weight of individuals, the fossil fuel equivalent of 1.3 billion gallons of gasoline was utilized in the production, transport and supply of the excess calories needed to maintain obesity¹⁰² with only 72% of the current US population.¹⁰³ More recently, a draft report from the US

Global Change Research Program published January 11, 2013 predicts that if current trends in greenhouse emissions and global climate change continue, US food security will be significantly impacted, with significant declines in both crop and livestock production due to increasing heat, precipitation and seasonal pattern change. This effect is expected globally with impacts both in the economics of the multibillion dollar food trade, as well as, from a global food availability perspective.¹⁰⁴

A more insidious aspect of US caloric intake and obesity is the effect on global political instability. Ehrlich and Liu, propose that one determinant of transnational terrorism is the perception of a “have and have not” situation, as well as, economic deprivation.¹⁰⁵ This was also proposed by Per Pinstrup-Anderson, a Cornell Babcock Professor of Food, Nutrition and Public Policy, in 2006 when he stated that there is increasing “rage at the growing disparity and unfairness between the rich and poor,” which will lead to increasing motivation to “commit acts of terror.”¹⁰⁶ Additionally, von Hippel suggests that a portion of terrorism is caused by the “dearth of western charitable and economic support to failing and poverty stricken areas.”¹⁰⁷ General George Casey discussed terrorism at the Brookings Institute on December 4, 2007.¹⁰⁸ He stated that “we’re at war with a global extremist network” and that all arms of government need to reverse conditions that facilitate recruiting for that network. He went on to discuss northern hemispheric prosperity in contrast to other areas, including the Middle East and Southeast Asia. He continued to discuss that the competition for water, resources and food would increase international friction and that energy supply will not equal demand in the future. General Casey specifically discussed climate change creating additional friction.¹⁰⁹ This view is shared by the National Intelligence Council

(NIC) who states that growing resource constraints combined with possible environmental degradation may be a “tipping point” leading to greater intra- or interstate conflict.¹¹⁰ This effect is compounded when it is noted that 70% of worldwide water usage is to support agriculture and is predicted to exceed current sustainable water supplies by 40% in 2030, and become one of the most contested resources.¹¹¹ Changes in the environment related to carbon emissions will create further resource scarcity and inequalities and is predicted to have proportionately greater impact in already unstable regions with high proportions of young males, further increasing intrastate conflict risks.¹¹² While terrorism is incredibly complex and multi-faceted, excessive food consumption in the face of world poverty and famine does little to stem recruitment of new anti-western activists in impoverished and disaffected youths. The combination of non-western perceptions, disproportionate wealth, poverty and diminishing resources in the face of climate change undoubtedly increases the risk of global instability and future military action at both the intra- and interstate levels.

Effects of Obesity Control and Reduced Calorie Consumption

In general, there is very little data on what reductions in obesity levels will produce from a cost reduction standpoint, nor what levels of weight loss will produce disease regression on the individual scale. There are however, a few sources that look at the effects of a reduction at the population level. Modest weight loss can result in a 20% reduction in all-cause mortality.¹¹³ Weight gain of 10-15 pounds increases the risk of diabetes by 50%, while a loss of 10 pounds can decrease it by 50%.¹¹⁴ At the individual level, one recent study demonstrated significant reductions in hypertension and metabolic syndrome for up to three years with significant weight loss in the morbidly

obese.¹¹⁵ In regards to overall mortality the results have been mixed. However, recent studies show decreases in diabetes related death, cardiovascular events and certain cancers. While the evidence seems clear that healthy individuals gain a greater benefit in mortality, the data are mixed for those with current obesity related disease and particularly in the elderly. Quality of life measures are poorly studied but current literature supports moderate weight loss.¹¹⁶

Wang et al. suggest that a 1% reduction in BMI across the United States would avoid 2.1-2.4 million cases of diabetes, as well as, 1.4-1.7 million cardiovascular disease patients.¹¹⁷ Utilizing the 2008 cost per patient per year data from the VA,¹¹⁸ this could save a potential of 4.85 to 5.5 billion dollars in diabetes care and 7.8-9.5 billion dollars in cardiac care in 2008 dollars in the United States. This would represent a potential decrease of 16-18% in the cost of diabetic care and 6-7% in cardiac care.¹¹⁹ It is further estimated that this BMI reduction would require approximately an average one kilogram weight loss per American, requiring a twenty calorie per day intake reduction and would be realized over three years.¹²⁰ This equals 1.25 teaspoons of sugar, 1/3 a slice of white bread or .25 ounces of ground beef.¹²¹ Ormond et al. estimate that a 5% reduction in diabetes and hypertension alone would save 9 billion dollars annually in the short term and 24.7 billion dollars annually in the medium term from prevention of further secondary illness.¹²²

In the VA a 5% reduction in the cost of caring for diabetes, stroke and cardiac care in line with those found by Wang et al. would save nearly 400 million dollars per year.¹²³ Additionally, a study from the CDC published in 2010 found that a 1% reduction in obesity and overweight in 16-17 year olds would yield lifetime medical care costs

reductions after age 40 of 463-691 million dollars.¹²⁴ This clearly demonstrates the long term impact on VA spending that active duty intervention can yield.

In a more aggressive approach, an average reduction of 200-400 calories per day, per American could lead to an average of 9-18kg weight loss and a return to 1990 weight levels over a three year period. Estimates are that this could prevent between 8.6 and 11 million cases of diabetes, 7.6 to 9.1 million cases of heart disease and stroke, and 668,000 cancers, along with an increase of 58.2-82 million additional quality-adjusted life years by 2030.¹²⁵ This translates into approximately 19.9-25.4 billion dollars in diabetes and 42.5-50.9 billion dollars in cardiac care by 2030.¹²⁶

These impacts on the general population would not only decrease GDP spending on medical care, freeing national resources for spending elsewhere or offsetting the current deficit, it would significantly increase the number of applicants eligible for military service. While there is no specific data that predicts reductions in attrition, medical boards and injuries due to weight loss stands to reason that there will be significant reductions in each, along with increased Soldier-years available to the force.

Decreased caloric consumption will have effects well beyond the pure economic impacts of decreased medical costs. Utilizing the aforementioned 400 calorie per person reduction, this would alleviate the requirement for 123.6 billion calories per day across the United States. Addition of the typical 29% percent lost to cooking, spoilage and waste¹²⁷ there is a net reduction in calorie production requirements of 159 billion calories per day, enough to feed more than 360,000 people for a year on a 1200 calorie per day diet or 280,000 people assuming equivalent spoilage rates. This reduction in domestic requirements could be utilized in multiple ways. Reduced requirements could

lead to changes in agricultural management and reduction of greenhouse gas emissions and water utilization, while increasing agricultural yield. Unneeded agricultural acres could be left uncultivated, seeded for soil management or converted to greenhouse gas reducing management techniques, not only alleviating the approximately one metric ton of greenhouse gas produced per acre,¹²⁸ but actually reducing the overall carbon emissions for the United States. This has been shown to be effective through land use and forestry changes, which in 2007 acted as a greenhouse gas sink, absorbing 17% of United States carbon emissions and 15% of total greenhouse gas emissions.¹²⁹ A 400 calorie per day reduction in consumption represents 15% of a 2700 calorie per day diet. In turn that could represent a decrease in the need for 61 million acres of agricultural land.¹³⁰ Further, the Environmental Protection Agency estimates that the agricultural sector produced 432 million metric tons of green house gases in 2007,¹³¹ or approximately 1 metric ton per acre¹³². A reduction of 61 million acres of agricultural use acres could therefore translate into approximately 61 million metric tons of carbon emissions, assuming proportionate decreases in all types of farming activities. A more long term approach would be replant and convert, in a rotational fashion, to systems that provide a carbon sink versus current emissions producing methods, while reducing water consumption.

Worldwide food demand is predicted to grow by more than 35% by 2030.¹³³ Part of this potential agricultural surplus could be used for export purposes to improve our trade balance. With growing food pressure across the world, the United States is well positioned to increase current food exports to key food trading partners such as China, India and Korea.¹³⁴ Average wheat yields of 48 bushels per acre¹³⁵ and rice of 7000

pounds per acre¹³⁶ in 2012, could yield up to 23 billion dollars¹³⁷ or 60 billion dollars¹³⁸ in gross revenue at current pricing, respectively. This would not only produce increased trade but increased international interdependence of critical recourses, which may provide areas of cooperation, diplomatic common ground and increased United States leverage in international economic diplomacy.

Alternately, increased grain and rice production could also be utilized in humanitarian relief efforts across the developing world, promoting international goodwill. This could help alleviate what the NIC refers to as “increasing contention over scarce resource issues” that increases the risks of interstate conflict.¹³⁹ The overall impact not only includes the short term economic and diplomatic improvements from direct food use, but long term impacts on climate change, water supply and population movements, all of which, however minimally, impact some of those factors which both General Casey,¹⁴⁰ the NIC¹⁴¹ and von Hippel¹⁴² suggest as contributors to global political instability.

Admittedly, these estimations are very simplistic in regards to very complex systems and represent an overall small percentage of GDP and production, and a full discussion of these topics is well beyond the scope of this manuscript. However they do serve to illustrate the possibilities and range of what could be done as part of a broad strategy in support of United States national objectives, stabilization of global dynamics and increase United States food security.

Treatment of Obesity

Obesity is typically categorized utilizing the BMI, which equals a person’s weight in pounds divided by their height in inches squared multiplied by a conversion factor of

703 (weight/height² X 703).¹⁴³ This provides a reliable indicator of the amount of fat in the human body. The BMI is then used to define the weight status of an individual. Obesity is defined by the Centers for Disease Control as a Body Mass Index (BMI) of 30 or more, while overweight is defined as a BMI of 25-29.9.¹⁴⁴ The military, however, utilizes body fat percentage in evaluation of fitness for service, in order to better account for the increased levels of muscle mass and fitness in military personnel. This method utilizes neck and abdominal circumference compared to height values to determine the body fat percentage. The level of allowable fat percentage varies with age and gender. Seventeen to twenty year old males are allowed 20% and females 30% body fat, increasing with age to a maximum of 26 and 36% for males and females, respectively, at age forty.¹⁴⁵ It is important to note that BMI and body fat percentage are not used interchangeably. BMI is used clinically in treatment of obesity, while body fat percentage is utilized in fitness for duty calculations.

As noted previously, obesity is an end state of the process of overconsumption combined with decreased caloric utilization. In combating it, we need to focus on the process of weight gain and loss. In its simplest terms, obesity and overweight are the result of energy consumption vs. energy expenditure imbalance. Any interventions in obesity therefore must focus on that process and changing the balance of the input/output equation. However, despite the simplicity of the concept that less caloric consumption plus more caloric expenditure yields weight loss, the conversion of changes in the caloric intake/expenditure balance into weight change is not straightforward. The widely distributed concept that 3500 calories equals a pound and therefore every 3500 calories you expend more than you take in results in a lost pound

is flawed.¹⁴⁶ This flawed concept is then widely found on the internet, taught in weight loss clinics, doctors' offices and in the gym leading to false expectations and the ubiquitously quoted reason for quitting weight loss plans of "I didn't lose any weight." A web search for the phrase "calories to lose one pound" yields hundreds of references stating that cutting 3500 calories equals a pound of weight loss.¹⁴⁷ In fact, the American Heart Association's website states that cutting 500 calories per day will yield one pound of weight loss per week.¹⁴⁸

While the expenditure of 3,500 calories is the net average energy of one pound of body weight, the body is dynamic. Linear associations are not borne out by research and dynamic modeling.¹⁴⁹ First and foremost, it must be remembered that a calorie is a measure of energy and pound a measure of mass. While the two measures are static, the relationship is dynamic. Hall, et al. reviewed the research in human weight loss and tested multiple dynamic models of weight loss relationships.¹⁵⁰ They came to several conclusions. They state that the static model of decreased calories leading to slow progressive weight loss ignores physiological adaptations to altered body weight in the form of altered baseline metabolic rates and changes in physical activity costs at different weights. Additionally, the static model fails, as it does not address the differing energy contents of fat versus muscle, nor the differing energy expenditures required to maintain them. Fat contains approximately 9,400 calories of energy, whereas, lean muscle contains 1,800 calories in each pound. Therefore, it requires a 5 fold increase in caloric expenditures to lose a pound of fat. To increase the complexity, lean tissue costs more energy to maintain and contributes more to baseline caloric expenditures. Also, initial levels of adipose in the body determine how energy imbalances are used or

stored through multiple physiologic mechanisms¹⁵¹ and this was described in validated mathematical equations.¹⁵² Finally, it must be understood that any fixed change in the caloric intake vs. expenditure level will reach a new baseline at approximately three years and further weight loss requires additional change.¹⁵³ Ultimately, a mathematical model was developed that utilizes the dynamics of how energy expenditures and imbalance “change over time as well as how energy imbalances are partitioned between storage or mobilization of body fat and lean tissue.”¹⁵⁴

Understanding this non-linear relationship is critical for several reasons. Both patients and those treating obesity or managing weight loss must be familiar with this relationship, because expectation management for those being treated for obesity is critical. Low initial weight loss is an independent variable for weight loss program dropout.¹⁵⁵ While there is little scientific data directly addressing the subject, it follows logical thought that expectations that fall short of reality will lead to higher dropout rates. Additional support is found when noting that higher dropout rates are seen in those who start with a lower BMI.¹⁵⁶ While studies have not looked at the relationship between lower BMI and rate of weight loss, understanding the dynamics supports that lower initial BMI leads to less initial fat and weight loss, compounding the missed expectations.

Second, understanding this weight loss relationship is needed by policy makers in order to make informed decisions and realistically assess possible outcomes of courses of action. When developing expected returns on investment a realistic model for both monetary savings and time frames can be obtained, preventing early cessation of programs that may work if time horizons are appropriately set.

Another group that needs to understand this dynamic weight loss issue is the young company commanders who may not have the experience and training to manage their unit's weight control program. They may inadvertently injure or attrite service members who may otherwise have been salvageable at a cost of 75,000 dollars each,¹⁵⁷ along with those skills needed by their respective service. In the Army specifically, this cannot be done without a reformulation of the Army's weight control program. Currently, AR 600-9 currently gives very specific guidance on how to weigh Soldiers, determine their body fat percentages and manage the administrative side of the program, including negative career consequences. However, there is only general guidance on things that service members can do to reduce calories. Its treatment requirements basically come down to six items that can be summed up as follows. Units will designate a fitness trainer and will do routine weigh-ins. Soldiers placed in the program will be provided nutritional educational classes by medical personnel and exercise program by the unit. Medical evaluations are only required if there is a duty limiting profile, pregnancy, and prior to separation (ETS or failure to progress in weight control).¹⁵⁸ Additionally, the Army Physical Readiness Training Manual¹⁵⁹ does not specifically address weight loss programs, only stating that they should participate in regular physical training, have extra low impact exercises and be referred to the Army weight control program. What is lacking is guidance on a holistic program of sustainable weight loss based on scientific evidence.

Compounding the issue is that recommendations for obesity treatment, policy and prevention in the Army are segregated by discipline. Nutritionists manage diet recommendations and physical therapy informs fitness policy. Primary care and

behavioral health make recommendations in relation to their particular specialties. The first step in both treatment and prevention requires that this change. These disparate and potentially conflicting processes need to be combined and leveraged at the US Army Medical Command (MEDCOM) level, as well as, the execution level. Primary care, behavioral health, nutrition, physical therapy, pharmacy and military planning should be combined into one recommendation body with a designated scope of responsibility and mission statement. This could be accomplished at the MEDCOM HQ level as an advisory body to The Surgeon General, who could in turn, provide advice to the Department of the Army, with evidence based, actionable plans that could then be executed through proper operations channels within the force.

Army weight control program policy should be rewritten to include specific guidance on unit and medical actions that create an individualized program of weight loss, managed by an installation level weight loss team, either managed by Installation Management Command (IMCOM) or MEDCOM and executed at the unit level. Studies have shown that both worksite interventions and programs of diet, physical exercise and cognitive behavioral training during work hours have been successful at weight loss.¹⁶⁰ Additionally, counseling by primary care providers can lead to sustained weight loss and behavioral change.¹⁶¹

A revised AR 600-9 would direct MEDCOM to provide actionable guidelines and standards of practice to the installation Medical Treatment Facilities (MTF) and provide resources for the institution of treatment teams. Additionally, the updates to the Clinical Practice Guidelines must have specific update intervals defined. At the action level, the treatment team would develop an individualized plan that would include nutritional

training and planning (caloric intake and quality), appropriate fitness training (both strength and endurance), behavioral health evaluation and behavior modification training, medical evaluation and realistic expectation management and goal setting. The program plan, as well as, expected and realistic goals would be communicated to the command team for execution and support. This would alleviate medical decision making on the part of the company commanders and first sergeants, while keeping their direct command and control of the Soldier intact. This would require training of commanders to understand the dynamics of weight loss and behavioral modification. Unit training NCOs and Master Fitness Trainers¹⁶² would need specialized training in weight loss physical fitness and should be included in a multidisciplinary individualized planning process.

While specific treatment level recommendations are beyond the scope of this manuscript, there are several things that could be considered for inclusion in military treatment of overweight and obesity. First and foremost, we must change the entire treatment paradigm from a focus on losing weight to a focus on what the Soldier wants to accomplish and why. This will create the motivation required to make the changes necessary to succeed. Next, would be the inclusion of mindfulness training in the behavioral modification process, which has been shown to improve weight loss, along with self monitoring.¹⁶³ Additionally, it has been shown that daily weight monitoring may lead to increased weight loss. Unpublished data from the VA's MOVE program has shown a 25% increase in weight loss with the institution of daily weights¹⁶⁴ and is further supported by recent research on weight self-monitoring. While conventionally accepted wisdom is that measuring weight daily causes increased drop out and frustration with

lack of weight loss and lowered self-esteem,¹⁶⁵ this could be easily corrected with realistic expectation management based on dynamic weight loss. Furthermore, more frequent weighing is supported by more recent literature with both daily and weekly weighing showing higher rates of weight loss.¹⁶⁶ Additionally, this would reinforce mindfulness training, in which part of the pre-caloric intake thought process is the effect on the next weigh-in. It must not become a punitive process, but weigh-ins should become a teachable moment and reinforce the importance of the program. This could be easily accomplished at the unit level with properly trained fitness coordinators.

The weigh-in process would further support the behavioral modification, self monitoring and mindfulness that must be key components to an individualized plan. Personalized plans, while time consuming and higher cost, have been shown to be significantly more effective than self-directed plans.¹⁶⁷ Additionally, while distributive, computer based monitoring and guidance has been shown to be more effective than self-directed plans, these are significantly less effective than personalized, face to face methods.¹⁶⁸ In fact, in a study of military members who were overweight, the addition of an accelerometer, combined with computer feedback and mandatory physical training, showed no changes in weight, resting heart rate, blood pressure and only one of 28 subjects passed the APFT and Height/Weight standards after 6 months.¹⁶⁹ Clearly, current methods are ineffective at changing behaviors and producing the desired results. Interactions with fitness, nutrition and medical professionals, along with unit leadership could reinforce the healthy habit formation model, which has been shown to produce significantly greater weight loss.¹⁷⁰

Beyond the active duty service member, this multi-disciplinary approach should be implemented for family members. The ongoing costs of medical care, unacceptable health risks and long term disability effect families. Access to individualized weight loss programs, combined with military families' access to a multitude of physical fitness facilities, programs and inherent support network provide an excellent opportunity for transitioning to healthy lifestyles. There are treatment and education opportunities within Army Community Service (ACS), who could manage spouse and children's weight loss support groups, provide educational opportunities and computer assisted weight loss. It has even been shown that the provision of a simple leaflet on habit formation and recommendations for eating and healthy behaviors may have beneficial effects.¹⁷¹ DoD Schools could participate through support, teaching of self monitoring and mindfulness training.

The VA's National Center for Health Promotion and Disease Prevention has recently initiated its MOVE program which combines behavioral modification, daily weigh-ins, expectation management, action-oriented goal setting, personalized support, dietary education and monitoring and evidence based motivational tools.¹⁷² Their early data shows approximately twice the weight loss with MOVE vs. traditional VA weight loss programs. Eighty percent of participants halt weight gain, 60% of participants lose some weight and 26% of participants lose 5% or more of their initial weight.¹⁷³ Follow-up data suggests that this weight loss is stable and not regained.¹⁷⁴

Last, from the Army specific perspective, there must be investment in training providers in the treatment and counseling of obese patients. A study on US Army family physicians demonstrated that while they understood the long term health risks of and

felt an obligation to treat obesity, only 75% were comfortable counseling patients on obesity and even fewer (49%) found it gratifying. Additionally, there were large variations in treatment recommendations and relatively few referral options. The authors also found that younger physicians and those in training were more likely to hold negative perceptions of overweight individuals.¹⁷⁵ These are the providers most likely to interact with line unit Soldiers and families, particularly at small Military installations. Military primary care training programs should add specific obesity treatment training to their programs, which is currently not specifically required by the American College of Graduate Medical Education.¹⁷⁶ It must be recognized that there is a cost associated with training current providers in counseling and weight management including travel/temporary duty and associated lost workload. Alternately, an expert travelling team could be used to train providers at their duty locations.

Prevention of Obesity

While there is conflicting evidence on the effect of weight reduction on the diseases associated with obesity, there is significant evidence that prevention of obesity prevents disease.¹⁷⁷ ACS and MEDCOM are uniquely positioned to implement not only programs designed for the active duty service member but also their families through community level programs for health, including within the DoD school system.

First and foremost, there must be a culture change across DoD, in which fitness and health are promoted and expected as the standard way of behavior. The Army Surgeon General has proposed a three-part model to be incorporated into the Army's "Ready and Resilient Campaign" and in July, 2012 directed development of the "Performance Triad."¹⁷⁸ This model stresses the importance of overall well-being and

includes nutrition, sleep and activity as the basic building blocks of readiness, resilience and a healthy lifestyle.¹⁷⁹ The “Performance Triad” campaign plan is expected to be released in July, 2013.¹⁸⁰ This will provide a basic building block focused on a culture change in our military and their families.

Additionally, the Army’s Comprehensive Soldier and Family Fitness Program is adding a physical fitness module in June of 2013.¹⁸¹ This will support the physical fitness aspect of the comprehensive model, complementing the social, emotional, spiritual and family modules that are already in use. The physical module will be more robust than previous modules and includes an assessment tool, based on evidenced based questions that are linked to mortality. It then provides recommendations on fitness programs based on the assessment, progress trackers and support sent through real time data analysis and weekly e-mail reminders. Additionally, it will gather composite data for analysis of the force as a whole and at unit levels for commanders to utilize in their unit fitness programs.¹⁸² The programs will require significant focus, resources and a long term outlook. Healthy habits and promotion by line leadership will be the keys to its success.

At its core, prevention must start in basic training. The Soldier Fueling initiative should be continued and expanded.¹⁸³ However, mindfulness training and healthy habit formation based on evidence based research should be included in all initial entry training platforms.¹⁸⁴ Physical fitness should be taught as a lifestyle habit and while obviously mandatory for service, the mindset should focus on fitness as a priority for health and well-being and its importance to success versus the punitive aspects of failure.

However, culture change cannot be created by only teaching health in initial entry training; it must be reinforced throughout the Soldier and families' life cycle. Mindfulness training, healthy lifestyle and habit behaviors should be incorporated into all developmental courses. There should also be standardized training developed for inclusion into unit specific training calendars. This could be performed by new "unit fitness coordinators," the current Master Fitness Trainers¹⁸⁵ or unit level medical staff and utilize the tools currently under development. However, it must be structured, monitored and outcomes followed. Additionally, the use of simple habit formation educational leaflets delineating simple behavior modifications could produce substantial gains over the long run.

Across the force there must be focus on our dining facilities. Changing the types of food provided in dining facilities can impact Soldiers' food choices. Improving the selection and type of healthy foods available can lead to a shift of eating patterns.¹⁸⁶ Additionally, given that 22% of the 32 teaspoons of added sugar equivalents Americans consume daily comes from sugared soda,¹⁸⁷ there is an opportunity to impact daily caloric consumption through replacing this with alternative beverages. The reduction of one 20 ounce soda per day would decrease caloric intake by 250 calories if replaced with a zero calorie alternative.¹⁸⁸ Additionally, current initiatives to label dining facilities' menu items in a red, green and amber fashion should continue, however, the addition of the total calories for each item should be stressed, as a "green" labeled food item becomes a caloric liability when consumed in quantity. Conversely, the addition of too much information, such as nutritional content may be overwhelming and counterproductive. Therefore, focusing on the main component of weight gain for

Soldiers (calories) is, perhaps, a more viable solution. Additionally, recent research has shown that physical activity based caloric labeling is more effective than data labeling. Studies have shown that food labeling that converts calories into the hours and distance of walking resulted in 200 calories per meal less ordered in restaurants¹⁸⁹ and activity based information decreased the amount of sugar sweetened sodas consumed.¹⁹⁰ This could easily be accomplished in military dining facilities. Consideration should also be made for more control of what food items are available and their portions. Removal of deep fried items, high sugar cereals and calorie dense desserts, and replacing them with increased fresh fruits and vegetables, whole grain cereals and low calorie drink options would improve nutritional quality, while decreasing caloric quantity. At a minimum, there should be an evaluation current practice and development of evidence based guidance for nutritional offerings at all dining facilities.

Additional to training the psychology of fitness, the dynamics of calorie utilization should be remembered, particularly that the greater the fat composition of the body the higher rate of fat deposition of excess calories there is. Additionally, since lean mass requires higher basal calorie expenditure, cross training and weight training for fitness should be incorporated into the Army physical fitness program starting in Individual Entry Training and continued throughout the military life cycle.¹⁹¹

Fitness training within the force should be reengineered based on current science. Cross-training, team building and aerobic and muscle fitness should continue to be stressed; however, opportunities for individualized programs and programs focused on elevated job performance should be developed. Military Occupational Specialty specific programs should be encouraged and a one size fits all fitness

program across all services and specialties is unrealistic and counterproductive. Fitness tests based on specialties should be considered, as it relates fitness to daily life and provides visible effects. As self monitoring and more frequent weigh-ins have been shown to decrease weight gain,¹⁹² there should be consideration for increased frequency of unit weight measurements. This would serve the dual purpose of prevention, as well as, normalization of the process and decreasing the stigmatization of those in the weight control program.

There is already some movement in reengineering Army fitness programs. Several units have initiated their own performance based training programs.¹⁹³ The Ranger Athlete Warrior program looks at fitness from the view of functional fitness (strength and endurance), performance nutrition, mental toughness (including sleep hygiene) and sports medicine (injury prevention and multi-disciplinary rehab).¹⁹⁴ The 4th Infantry Division has developed a similar program, as have other units.¹⁹⁵ Currently, the U.S. Army Medical Command's Injury Prevention/Human Performance Optimization group is performing an outcome study in three Combat Arms Battalions to identify the best performing program and will make recommendations upon study completion for an Army wide program.¹⁹⁶ Additionally, this group is developing the Military Power, Performance and Prevention tool (MP3 program) which is a computer based fitness tool which can be used at the unit level. It utilizes evidence based screening tests which assess for injury risks and provides prevention strategies at both the individual and unit level. It will also assist in developing unit specific programs based on what the unit feels it needs, i.e. strength, anaerobic fitness etc. It also has portability into the medical record and can track prescribed exercises and educational classes.¹⁹⁷

Prevention of obesity within military families is critical to their health, the sustainment of our military medical system and our future. The habits learned in childhood will carry throughout life, so our DoD schools are a phenomenal opportunity for long term gain, and are a prime target of opportunity for the development of a generation of Americans with healthy lifestyle habits. The first step is to ensure school lunch menus are nutritious and replace fried foods with more healthy choices. A good start point would be for all DoD schools to participate in the Healthier U.S. School Challenge¹⁹⁸ and the Let's Move Program.¹⁹⁹ Child Development Centers should also be required to adopt the tenants of the Let's Move Program. Programmed physical activities, recess and after school physical programs should be initiated or increased. In the mean time there should be a scientific advisory board assigned to the evaluation of and recommendations for DoD based school health, nutrition and education programs. This nutritional education should be mandated and should include healthy choice, cooking, self-monitoring and mindfulness components. Additionally, there should be consideration for a program similar to Japan's school lunch program in which there is no choice and meals are made from scratch, which is believed to have helped lead Japan to the lowest child obesity rates in the world.²⁰⁰ Additionally, vending machines should be removed from schools, as soda, snack and candies are significant sources of refined sugars with little nutritional value and support development of deleterious eating habits.²⁰¹

According to Dan Glickman, former Secretary of Agriculture, healthy eating requires a combination of three things; accessibility, good taste and price.²⁰² This makes intuitive sense. The DoD is poised to address each of these areas. DoD

beneficiaries have access to healthy foods through our commissaries and exchanges. DoD also has mass purchasing power and access to nutritionists and trainers across the force.

We eat what tastes good, but in the current fast paced climate, particularly in the military, many do not have the time to cook and many do not know how to make healthy meals that taste good. It is just easier and faster to stop at the on-post Burger King than make a nutritious and tasty meal at home. ACS should provide healthy cooking classes and meal planning tools and guidance aimed at the busy parent. Additionally, there should be training for the single soldier and barracks based tools, such as “healthy microwave cooking” and group meal planning for those who do not eat in a dining facility. Nutritional education should be mandatory for maintenance of Commissary privileges. However, to support this, the Commissary should provide improved labeling practices and supply large quantities of high nutritional foods, fruits and vegetables at a lower cost. Additionally, the Commissary should change its marketing and advertising, and particularly, product placement to make picking healthier foods easier. The Commissary service could initiate a program similar to the one launched by Wal-Mart in conjunction with the First Lady’s Let’s Move Program in January, 2011 which aims to use their significant purchasing power to force suppliers to decrease sugar and fats in prepared food preparations, decrease costs on healthy choices and provide improved labeling.²⁰³ While initially, it would have to be done within the Commissary system, local labeling could include activity based caloric labeling.

The Army and Air Force Exchange (AAFES) should do two things. First is to require nutrition information labeling by all food vendors in military exchanges, including

activity based labeling. Currently, unless directed by state law, this is at the discretion of the vendor. Additionally, AAFES should replace a portion of their current fast food vendors with healthier choice options or at a minimum make healthy food choice vendors available. Additionally, AAFES or the Commissary could explore agreements with local farmers and other producers for on post local produce markets on a recurrent basis during the growing season. This could not only improve the health of the Army family, but encourage community bonds and mutual support, as well as, supporting the local business economy. Alternately, the Commissary could purchase local produce for sale in the Commissary. This would require changes to current Defense Commissary Agency and Army/Air Force Exchange policies regarding procurement activities.

Beyond healthy eating initiatives we must focus on a culture of overall wellness. There is a clear association between neighborhood environments and obesity, with neighborhoods that encourage healthy activities, such as walking to work or school, having lower rates.²⁰⁴ Installation Management Command and privatized housing providers should develop healthy environments on military installations with the addition of more bike and walking paths, bike parking, sidewalks and community fitness areas. Bike and walking paths should be separated from vehicular traffic areas for safety and ease of use and should connect all of the major installation facilities, not only improving fitness, but decreasing short distance vehicle travel. There should be both indoor and outdoor fitness areas (playgrounds, gyms, tracks etc) particularly in areas where warm space training areas are at a premium. The MP3 program could be exported to family members through ACS. This should be coupled with programs that encourage utilization of the facilities such as sports leagues, family outings, incentives and aggressive

promotional campaigns. Additionally, there should be consideration of bike share programs and during duty hour fitness programs for GS employees within the DoD and VA systems.²⁰⁵

Military Treatment Facilities (MTF) must do more than just support local units with education and nutrition support and obesity treatment. They must model the transition to a healthy culture. Hospitals should educate, promote and support breastfeeding which has been shown to decrease obesity rates.²⁰⁶ It is estimated that this alone could save 13 billion dollars annually.²⁰⁷ DoD treatment facilities should incorporate the tenants of the Healthier Hospital Initiative into their nutritional services.²⁰⁸ Additionally, MTFs should provide outreach directly into ACS, line units and community groups with a sustained message of habituating healthy behaviors. Last, military treatment facilities should aggressively pursue the medical home concepts of increased primary care and prevention with a focus on healthy outcomes. Providers and staff within the medical homes will need support and training on obesity prevention and behavioral modification therapies. Dr. Guy Clifton contends that adequate numbers of primary care physicians, given adequate time to provide preventive services, while monitoring standards and outcomes is paramount to bringing obesity and the medical costs of chronic disease under control.²⁰⁹

To move individuals from overconsumption and sedentary lifestyles will require more than just good intentions, promotion and available tools. There will need to be personal incentives for people to participate and change. Talking about the costs of medical care in the future has no direct impact on military families or retirees who pay little to nothing out of pocket for healthcare and just saying you will live longer is unlikely

to be effective. There is little in the way of disincentives, other than a height weight chapter discharge for the service member and none for families. The problem is that currently there are no true incentives either. Until there is a balance of disincentives and incentives, there will only be entropy and worsening obesity, because in the absence of a compelling reason to act, it is easiest to do nothing, particularly when there are so many things competing for a family's time.

There are many possible incentive programs that could be used. The simplest is recognition. A program that marks an on-post home as a "healthy" home for meeting specific criteria or badges for children at school. There should be a development of community pride as the community becomes healthier, as in Saddleback church in Texas whose 1500 members that participated in a community based weight loss program lost a combined 250,000 pounds over the program's first year.²¹⁰ There could be monetary incentives placed that are removed for unhealthy behaviors. For example, every Soldier receives 500 dollars each year, but loses a portion for smoking, a portion for being overweight etc. This could be expanded to families. Weight loss incentives could be used that reward families with discounts at local attractions. TRICARE could also restructure in a manner similar to Safeway in which the first 1,000 dollars in health care is paid by the company, followed by the second 1,000 dollars by the beneficiary, then at a fixed co-pay percentage rate for the remainder for the year.²¹¹ However, this would not work for those in the military or VA's direct care system, so another option could have TRICARE rates increased, but then discounts given for healthy behaviors and weight. This would be similar to reductions for those taking part in Safeway's "Healthy Measure's" program which has resulted in obesity rates that are 70% of the

national average and four years of stable medical expenditures despite 40% growth at other companies.²¹² Regardless of the program, there must be a personal interest in order to change the culture.

As rate of rate weight gain has been shown to increase with increasing weight,²¹³ it is clear that early intervention is paramount. In the military system, obesity has its most pronounced effects at the VA level where the greater levels of obesity and overweight are being seen. As such, the VA health system will see the greatest long run gains from early prevention efforts. The Active Army will see the less demonstrable gain while providing the majority of early prevention activities. So, while this cultural change must start in the active force, it must focus on the long term and work in conjunction with VA programs.

In light of this, it should be recognized that fitness and height/weight standards are a condition of employment within the military service. However, after retirement there is not a change in pay or benefits based on health status, in fact the current system can potentially reward poor health conditions. The combination of removal of this condition of employment with the lack of monetary or short term consequences at the time of retirement is a clear lead in for weight gain-particularly in those who are already overweight.²¹⁴ Additionally, some retiring personnel may take an attitude of “I am done with that,” and stop exercising because they finally have control over it. Regardless of why, it is clear that the VA spends billions in obesity related health care and the problem is worsening.

Education should not stop at the time of retirement and specifically, obesity and nutrition education should be part of the separation process. Behavioral health is

evaluated at discharge from military service and so should other health risks; to include a prevention program based on the same behavioral habits that were developed during the active duty life cycle. There should be specific training on the risks of weight gain and loss of fitness during this time period and upon entry into the VA system.

Additionally, it should be stressed to the retiring Veterans that they will no longer need to eat like they are doing heavy physical training or engaging in combat and they must adjust their habits to their new activity levels and lifestyle. The VA could then implement many of the same educational programs for healthy cooking and nutrition, but tailored to their population who has different requirements from a young active duty population. The more complex care delivery, geographic spread of beneficiaries, disparate age ranges and the lack of negative and positive incentives will be particularly difficult in the VA system. However, the VA has already implemented a health care cultural change office and has dedicated obesity research and implementation teams, placing them in a position to continue forward progress without having to establish new organizations.²¹⁵

The most critical change that must be made is in management of MEDCOM and VA budget allocations and priorities. The US Army Surgeon General is currently developing an aggressive plan for overall transformation of Army Medicine to a “System of Health,” and the Army Medicine 2020 Campaign Plan defines this System for Health as “a partnership among Soldiers, Families, Leaders, Health Teams, and Communities to promote readiness, resilience, and responsibility.”²¹⁶ What must change to make this a reality is a refocus of monetary allocation, metrics tracking and performance reimbursement that focuses on prevention. The current system of relative value units

simulates a fee for service model that does not work within a prevention based model of health care. The vast majority of tracked metrics revolve around productivity, procedures and treatment of illness. Military Treatment Facilities are not reimbursed for prevention activities and to stay solvent, must focus all available clinical assets to the care of disease processes. This inevitably leads to the same inefficiencies described in the civilian health care system by Dr. Clifton.²¹⁷ Further compounding this are the current budget constraints that lead to decreased staffing levels, ward closures and lost training time. This creates a system that cannot afford to prevent disease, nor train its staff to do so. In order to correct this, a new reimbursement system must be created in which either medical facilities are able to “charge” the Defense Health Agency for preventive services, counseling and community outreach or the Department of Defense will need to revert back to a true capitation or Health Maintenance Organization model.

Combined with budgetary change must be a change in metrics. If people do what others watch, then our current system of metrics compounds wasteful medical practices and inefficiency. There are some measures of effectiveness monitored such as the Healthcare Effectiveness Data and Information Set,²¹⁸ which follows rates of preventive services such as mammograms and colonoscopies. However, as an organization, we predominantly look at measures of performance and primarily on productivity and per capita financial data. In order to decrease obesity and the diseases related to it, MEDCOM must focus on quality metrics. Further, monies from the Defense Health Agency, Installation Management Command and Department of Defense must be allocated specifically to programs that are evidence based and proven effective in obesity prevention, as well as, for projects that promote healthy lifestyles. Lastly, it must

be clearly understood that there will not be a large demonstrable monetary return on investment, particularly in the short term. It is difficult to prove what is prevented and DoD must have the patience and resolve to look at the long term impacts with a global view, despite the short term expense and the likelihood that the majority of gains will be realized outside of DoD and will be most prominent in the VA, disability systems, and federally sponsored medical programs occurring after release from active duty.

The military is a microcosm of the civilian world, but the control, visibility and leadership within the military provide a unique opportunity to impact obesity in a way that would be difficult in the civilian population. That does not mean, however, that the lessons learned in the military environment cannot be utilized by the nation as a whole. What it does provide is a small scale, controllable environment in which programs can be implemented with flexibility and speed that cannot be matched. Furthermore, it provides an opportunity to evaluate the outcomes of the programs in a scientific way that can be shared with the population at large. All the programs utilized on military installations and in the VA have civilian corollaries that can be implemented on a large scale and with evidence based support from the military experience.

Programs found effective in the DoD school system should be ported to all public schools. Removal of vending machines is more problematic for public schools as they may rely on that income. However, with data from DoD, the national and state governments will have the evidence to support increased funding to schools to make up for that shortfall, with the understanding that there will be a net positive long term return on investment. Similarly, school lunch programs could be more adequately funded and monitored with the same return on investment argument. The “DC Healthy School Act of

2010” puts these principles into action with a program of physical activity, nutritional education, school meal access and standards, local produce utilization and restriction of outside food and snack vendors. This is combined with monetary and non-monetary incentives to schools that meet specific thresholds.²¹⁹

Based on changes that could be made within the DoD health system, the federal government should reform the Medicare reimbursement system to a prevention based model in which preventive services are reimbursed. Alternately, a patient based model that stresses primary care of the patient and not a procedurally based fee-for-service system would encourage primary care providers to engage in prevention in order to decrease unneeded acute and chronic care, which in turn would lessen the obesity rates and complications of obesity related diseases. Insurers would follow the lead of Medicare and also change reimbursement programs. The primary care provider-patient relationship must be the focus, but there should also be the ability to reimburse non-physician based prevention services that are working in a coordinated fashion with the primary care provider. This should include out of office based preventive services and not just those based in clinical settings. Demonstrated cost avoidance “profits” should be shared with the care-givers and prevention staffs, providing a greater incentive to standardize and improve prevention.²²⁰

Additionally, there must be national level efforts to promote primary care and other professions that effect prevention. Direct reimbursement is the starting point; however, training institutions must develop programs of study that are sustainable. Further, all medical training should include nutrition and healthy lifestyle training, including how to counsel.²²¹ While there are loan forgiveness programs available to

some physicians, there could be scholarships and subsidies for those who enter other preventive health training programs or medical school who commit to the public health services with specific emphasis on prevention or in underserved areas.

The government cannot control obesity alone, but must partner with the business community. It must be understood that corporations exist in order to make a profit. Simple recommendations or government directives are therefore unlikely to work, as shareholders and executives will reject voluntary actions that will negatively impact their company.²²² Ultimately, there will have to be a combination of directed and voluntary efforts.²²³ These efforts will have to focus on two areas. First the corporate responsibility for the health of their workforce and second the health of the consumer.

Programs and policies must be in place, such that it is beneficial for business to promote the health of their work force. Similar to the military workplace fitness programs and based on the data from Christenson et al. and Morgan et al.²²⁴ the government could support workplace fitness programs through subsidies, tax credits or through reduced Medicare contributions. Insurance companies should be encouraged to also provide similar incentives. Additionally, there could be benefits for those organizations that provide preventive health services to their employees. Companies should share in realized gains from their prevention efforts, while not being allowed to profit from hollow programs. Therefore, there must be metrics attached to any financial incentives. This must be accompanied by education of the business community on the benefits to the long term profitability of their companies from both the increased productivity and decreased disability standpoints.

Restaurants and package food companies are a prime area for government help. It was shown by the Hudson Institute in a recent study that low-calorie foods can lead to same store sales growth in the face of declining sales of general restaurant menu items.²²⁵ As 47% of American food dollars are spent in restaurants,²²⁶ educating the business community of the profitability of healthy choices will create partnership with corporate entities that can both fuel economic growth and revenue, while promoting healthy lifestyles. Additionally, there should be governmental support to restaurants, grocery stores and packaged food chains that take part in programs such as those done by Darden in conjunction with Partnership for a Healthier America creating comprehensive changes to Darden's children's menus and overall calorie reductions.²²⁷

The government has a long history of legislating safety issues from seat belts, industrial safety standards, speed limits to unsafe foods. As a significant safety and health issue, government regulation of certain aspects of the food trade will be required. Many areas currently require restaurants and vendors to post calorie counts of their food items. Currently, proposed calorie count legislation that was included in the 2010 health care law is on hold.²²⁸ This should be made a national regulation and standardized across all the states for consistency and ease of use.²²⁹ Taxes are another option that has been utilized in some areas, likening it to the taxes on smoking which led to a 35% decrease in use.²³⁰ Sodas are a particularly likely target, as they have been suggested as one of the top contributors to the obesity epidemic.²³¹ Wang et al. suggest that a national 1 cent per ounce tax on sodas would decrease consumption by 15-25%. They further suggest that based on expected rates of calorie substitution, this would lead to an approximate weight loss of 0.9 pounds at the population level,

realized over a three year period. However, this would be greater in the younger age groups who drink more soda. It is estimated that this seemingly small weight loss would result in 867,000 less obese adults and a 2.6% reduction in diabetes. Additionally, they estimated the avoidance of 95,000 cases of coronary artery disease, 8,000 strokes and 26,000 premature deaths. Overall, this would create a net savings of more than 17 billion dollars over ten years. Even if 100% of the calories were replaced with other non-sugared beverages, there would still be a net 6.7 billion reduction in medical costs, and up to 20 billion dollars saved if none of the calories were replaced at all.²³² The tax revenue could be earmarked for research and medically related federal budget expenses.²³³ Other unhealthy choices could be taxed similarly if soda taxation proved successful. This should be combined with significant restrictions on advertising and marketing practices, primarily those aimed at children.

Referring back to former Secretary Glickman's comments that what is eaten is determined by what is tasty, accessible and cost effective, there should be expansion of programs that encourage grocery chains to make healthier, lower cost options available to economically depressed areas.²³⁴ This should include subsidies, programs or policies that encourage grocery chains to bring in fresh produce to areas where they are typically not available.²³⁵ Further, farming subsidy programs should be reengineered in order to support environmentally sound planting practices, as well as, provision of healthy fresh foods to "food deserts" where access is limited, thus forcing individuals to buy calorie dense, higher-fat options. Additionally, the federal food subsidy program (formerly "food stamps") should restrict the purchase of those foods and products known to present a health risk, such as sugar-sweetened sodas. This should be

combined with provision of education on good-tasting, healthy meal preparation for the busy individual.

Beyond caloric intake, caloric expenditures must be targeted. City planners, community civic groups, corporations, commercial builders and rental companies all have impacts on lifestyle choices. City and community planners, similar to military organizations, should develop safe walking and bike paths and adapt zoning restrictions to conform to a healthy lifestyle. Overall city plans should use evidence based research in the development of communities that promote walking and other healthy choices. Parks and recreational facilities should be accessible and promoted. Land development agencies and commercial builders should be given incentives to design communities supporting a healthy lifestyle, including access to fitness areas, walking paths and preserved green space.²³⁶ Corporations could be given tax benefits or insurance rate cuts for providing gym memberships, free in-house fitness training, and architectural designs that promote healthy living.

All of the recommendations must be tied together with an aggressive public awareness campaign. Messaging must be targeted to specific audiences through appropriate media. Obesity and overeating messaging must include targeting of adolescent to middle aged individuals as the weight risk is climbing in this group.²³⁷ Additionally, parents should receive healthy cooking and childhood obesity messaging, while informing businesses of the profitability of healthy products and a healthy workforce. Dedicated research on the group psychology of overeating and prevention is also needed. As a population, it is possible that we are giving tacit permission to overeat. Additionally, it is not certain if the general population truly understands the risks

of obesity and the effect on their longevity. Based on this data, all public institutions could provide age appropriate education. Government subsidy programs should include simple lifestyle habit and healthy eating materials. Finally, a joint public and private sector public awareness program across all media will be required with repeated and consistent messaging, similar to those undertaken in the anti-smoking and HIV prevention campaigns.²³⁸

Last, despite shrinking budgets, research must be supported through private sector incentives and public monies. Both the CDC and the Department of Agriculture should maintain adequate funding for food security and obesity related research. The public and private sectors should encourage and support partnerships in research and evaluation with the evidence based findings quickly incorporated into ongoing initiatives and legislation.

Conclusion

It is clear that excessive caloric consumption and decreased caloric expenditures, as well as, the obese condition itself pose a significant strategic risk across many facets of American security. Predominantly, obesity continues to fuel the escalating and unsustainable levels of medical expenditures but has far reaching impact. Finance, medicine, economics, the environment, diplomacy, agricultural and industry, international trade, defense, education and the American psyche are all intimately bound and impacted by America's overeating, sedentary lifestyle and the resultant epidemic of overweight and obesity. Obesity can be reduced and its impacts mitigated and even reversed. There is no panacea and no simple, single governmental program that will correct this incredibly complex problem. There will need to be multiple small

and large changes made simultaneously by both public and private institutions. There must be a dedicated focus on our youth and their long term health and lifestyle choices. A combination of legislative changes, public awareness, business incentives, professional education, medical reform, public/private partnerships and personal incentives are the initial steps, followed by research and evaluations of outcomes. Ultimately, this will lead to a paradigm shift in the way Americans view health and food.

Endnotes

¹ Ogden, Cynthia L., et al. "Prevalence of Obesity in the United States, 2009-2010." NCHS Data Brief No. 82 (January 2012), 3

² Wang, Claire, et al., "Health and Economic Burden of the Projected Obesity Trends in the USA and UK." *Lancet* 378 (August 2011): 815-825.

³ Ogden, Cynthia L., et al. "Prevalence of Overweight, Obesity, and Extreme Obesity Among Adults: United States, Trends 1960–1962 Through 2007–2008." June, 2010, http://www.cdc.gov/nchs/data/hestat/obesity_adult_07_08/obesity_adult_07_08.pdf (accessed February 20, 2013), 5.

⁴ Ogden, "Prevalence of Obesity in the United States, 2009-2010."

⁵ Ogden, "Prevalence of Overweight, Obesity and Extreme Obesity Among Adults: United States, Trends 1960-1962 Through 2007-2008," 5.

⁶ Flegel, K. M., et al. "Prevalence of Obesity and Trends in the Distribution of Body Mass Index Among US Adults, 1999-2010." *Journal of the American Medical Association* 307, no. 5 (February 1, 2012): 491-497.

⁷ Roger VL, et al; on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. "Heart disease and stroke statistics—2012 update: a report from the American Heart Association." *Circulation*. 125 (January 3, 2012): e152-59. Available at http://www.heart.org/idc/groups/heart-public/@wcm/@sop/@smd/documents/downloadable/ucm_319588.pdf (accessed 27 September, 2012).

⁸ Ibid.

⁹ Shamseddeen, Hazem, et al. "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes." *Surg Clin N Am* 91, no. 6 (December 2011): 1163-72.

¹⁰ Armed Forces Surveillance Center. "Diagnosis of Overweight/Obesity, Active Component, U.S. Armed Forces, 1998-2010." *Medical Surveillance Monthly Report* 18, No. 1 (January, 2011): 7-11.

¹¹ Ibid.

¹² This data is from US Army Public Health Command, Aberdeen Proving Ground, MD, provided by epidemiologist Paul Pietrusiak on October 1, 2012.

¹³ Almond, Nathaniel, et al. "The Prevalence of Overweight and Obesity among U.S. Military Veterans." *Military Medicine* 173, no. 6 (June 2008): 544-49.

¹⁴ Ibid.

¹⁵ Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-825; Shamseddeen, "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes," 1163-72; Moriarty, James, et al. "The Effects of Incremental Costs of Smoking and Obesity on Health Care Costs Among Adults: A 7-Year Longitudinal Study." *Journal of Occupational and Environmental Medicine* 54, no. 3 (March 2012): 286-91; Finkelstein, Eric, et al. "Annual Medical Spending Attributable to Obesity: Payer and Service-Specific Estimates." *Health Affairs* 28, no. 5 (July 2009) 822-31.

¹⁶ Pender, John and Pories, Walter, "Epidemiology of Obesity in the United States." *Gastroenterology Clinics of North America* 34 (2005): 1-7; Shamseddeen, "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes," 1163-72.

¹⁷ Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-25; Pender and Pories, "Epidemiology of Obesity in the United States," 1-7; Moriarty, "The Effects of Incremental Costs of Smoking and Obesity," 286-91; Finkelstein, "Annual Medical Spending Attributable to Obesity," 822-31.

¹⁸ Shamseddeen, "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes," 1163-72; American Heart Association, "Statistical Fact Sheet 2012 Update," e152-9; Moriarty, "The Effects of Incremental Costs of Smoking and Obesity," 286-91.

¹⁹ Ibid.

²⁰ Roger VL, "Statistical Fact Sheet 2012 Update," e152-9; Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-25; Shamseddeen, "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes," 1163-71.

²¹ Pender and Pories, "Epidemiology of Obesity in the United States," 1-7.

²² Peter R. Orszag, Director, Congressional Budget Office, *Long Term Budget Outlook before the House of Representatives Committee on the Budget*, 110th Cong.,

1st sess., December 13, 2007, 1.

http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/88xx/doc8884/12-13-ltbo_testimony.pdf (accessed November 15th, 2012).

²³ Peter R. Orszag, Director, Congressional Budget Office, *Long Term Budget Outlook before the United States Senate Committee on the Budget*, 110th Cong., 1st sess., June 21, 2007, 1.

<http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/82xx/doc8255/06-21-healthcarereform.pdf> (accessed November 15th, 2012).

²⁴ Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-25.

²⁵ This data is from the Patient Administration Systems and Biostatistics Activity, Ft. Sam Houston, TX, provided by research assistant Jenny English on February 19, 2013.

²⁶ Shamseddeen, "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes," 1163-71; Moriarty, "The Effects of Incremental Costs of Smoking and Obesity," 286-91; Roger VL, "Statistical Fact Sheet 2012 Update" E152-9.

²⁷ Roehrig, Charles, et al., "National Health Spending By Medical Condition, 1996-2005." *Health Affairs* 28 no. 2 (February 2009): 358-367; Shamseddeen, "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes," 1163-71; Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-25.

²⁸ Ibid.

²⁹ Ibid.

³⁰ Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-25; Roger VL, "Statistical Fact Sheet 2012 Update," e152-59.

³¹ Shamseddeen, "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes," 1163-72; Moriarty, "The Effects of Incremental Costs of Smoking and Obesity," 286-91.

³² Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-25.

³³ Data obtained from <http://www.usfederalbudget.us/> (accessed January 24, 2013).

³⁴ Data obtained from the World Health Organization: <http://www.who.int/countries/usa/en/> (accessed January 24, 2013).

³⁵ Data obtained from the World Bank: <http://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS> (accessed January 24, 2013).

³⁶ Data obtained from <http://www.usfederalbudget.us/> (accessed January 24, 2013).

³⁷ Dall, Timothy, et al., "Cost Associated With Being Overweight and With Obesity, High Alcohol Consumption, and Tobacco Use Within the Military Health System's TRICARE Prime-Enrolled Population." *The American Journal of Health Promotion* 22, no. 2 (November/December 2007): 120-139.

³⁸ Ibid.

³⁹ Yoon, Jean, et al., "Recent Trends in Veterans Affairs Chronic Condition Spending." *Population Health Management* 14, no. 6 (December 2011): 293-8.

⁴⁰ Ibid.

⁴¹ Ibid.

⁴² This data is from the Decision Support Cell, Office of the Surgeon General, Washington DC, provided by the department chief, LTC Mark Swofford on February 16th, 2013.

⁴³ Ibid.

⁴⁴ Pender and Pories, "Epidemiology of Obesity in the United States," 1-7.

⁴⁵ Shamseddeen, "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes," 1163-72.

⁴⁶ This data is from the Patient Administration Systems and Biostatistics Activity, Ft Sam Houston, TX, provided by research assistant Jenny English on February 19, 2013.

⁴⁷ Ibid.

⁴⁸ Ibid.

⁴⁹ Skunkard, Albert J., et al., "Depression and Obesity." *Biological Psychiatry* 54, no. 3 (August 2003): 330-337.

⁵⁰ Ibid.

⁵¹ Ibid.

⁵² Dutton, GR, et al., "Examination of the Relationship Between Obesity and Suicidal Ideation." *International Journal of Obesity* advanced online publication (January 15th 2013):1-5. doi: 10.1038/ijo.2012.224.; Klinitzke, G., et al., "Obesity and Suicide Risk in Adults-A Systematic Review." *Journal of Affective Disorders* 154, no. 3 (March 2013):277-84. Epub ahead of print August 4, 2012.; Zhang, J., et al., "Body Mass Index and suicidal Behaviors: A Critical Review of Epidemiological Evidence." *Journal of*

Affective Disorders epub ahead of print (September 20, 2012) doi: 10.1016/j.jad.2012.05.048.

⁵³ Lin, Hung-Yen, et al., "Psychiatric Disorders of Patients Seeking Obesity Treatment." *Psychiatry* 13, no. 1 (January, 2013) epub: doi: 10.1186/1471-244X-13-1. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3543713/> (accessed October 3, 2012).

⁵⁴ Dutton, GR, et al., "Examination of the Relationship Between Obesity and Suicidal Ideation," 1-5.

⁵⁵ Roos, E., et al., "Relative Weight and disability Retirement: A Prospective Cohort Study." *Scand J Work Environ Health* (October 11, 2012): 1-9, epub ahead of print pii: 3328. doi: 10.5271/sjweh.3328.

⁵⁶ Ibid.

⁵⁷ Ibid.

⁵⁸ US Army G-1 "PPG-TAB A: Amplification of the minimal standards of fitness for deployment to the CENTCOM AOR; to accompany MOD Eleven to USCENTCOM Individual Protection and Individual/Unit Deployment Policy" March, 27, 2012.

⁵⁹ Kuikka, PL, et al. "Knee injuries related to sports in young adult males during military service-Incidence and risk factors." *Scand J Med Sci Sports*, October 7, 2011. <http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0838.2011.01397.x/abstract;jsessionid=2A6551F9C112211F6D2E92EDB4D5B522.d02t01?systemMessage=Wiley+Online+Library+will+be+disrupted+on+23+February+from+10%3A00-12%3A00+BST+%2805%3A00-07%3A00+EDT%29+for+essential+maintenance> (accessed January 30, 2013); Yard, E, Comstock, D. "Injury patterns by body mass index in US high school athletes." *J Phys Act Health* 8, no. 2 (February 2011): 82-91; Reynolds, K, et al. "A comparison of injuries, limited-duty days, and injury risk factors in infantry, artillery, construction engineers, and special forces soldiers." *Military Medicine* 174, no. 7 (July 2009): 702-8; Waterman, BR, et al. "Epidemiology of Ankle Sprain at the United States Military Academy." *Am J Sports Med* 38, no. 4 (April 2010): 797-803; Cowan, DN, et al. "Musculoskeletal Injuries Among Overweight Army Trainees: Incidence and Health Care Utilization." *Occup Med (Lond)* 61, no. 4 (June 2011): 247-52.

⁶⁰ Accession Medical Standards Analysis and Research Activity, "*Tri-Service Disability Evaluations Systems Database Analysis and Research Annual Report 2011*" (Walter Reed Army Institute of Research, Silver Springs, Maryland), 1st Quarter, 2012: Table 4.

⁶¹ Ibid., Table 14A.

⁶² Ibid., Table 15A.

⁶³ Niebuhr, David, et al. "Risk Factors for Disability Retirement Among Healthy Adults Joining the U.S. Army." *Military Medicine* 176, no. 2 (February 2011): 170-4.

⁶⁴ US Army G-1, "Joint Army/VA Senior Leader Conference, Integrated Disability Evaluation System Update," briefing slides, Pentagon, Washington, DC, February 12, 2013.

⁶⁵ Armed Forces Surveillance Center. "Diagnosis of Overweight/Obesity," 7-11.

⁶⁶ This data is from US Army Public Health Command, Aberdeen Proving Ground, MD, provided by epidemiologist Paul Pietrusiak on October 1, 2012.

⁶⁷ US Army G-1, "Joint Army/VA Senior Leader Conference, Integrated Disability Evaluation System Update," briefing slides, Pentagon, Washington, DC, February 12, 2013.

⁶⁸ Ibid.

⁶⁹ Calculated using $(365 + \text{processing time}) / 365 \times 11,533$.

⁷⁰ Accession Medical Standards Analysis and Research Activity, "*Tri-Service Disability Report 2011*," 19-20.

⁷¹ This data is from Human Resources Command, as transmitted through the Transition Point Processing System from the Defense Manpower Data Center, provided by Scott Kuhar, Chief, Transition Branch.

⁷² Accession Medical Standards Analysis and Research Activity home page, <http://www.amsara.amedd.army.mil/Default.aspx> (accessed 28 January, 2013).

⁷³ This is based on the 6.5% and 48.8% estimates from the previous example.

⁷⁴ Packnett, Elizabeth R., et al, "Body mass index, medical qualification status, and discharge during the first year of US Army service." *Am J Clin Nutr* 93, no. 3 (March 2011): 608-14.

⁷⁵ Bedno, Sheryl A., et al. "Association of Weight at Enlistment With Enrollment in the Army Weight Control Program and Subsequent Attrition in the Assessment of Recruit Motivation and Strength Study." *Military Medicine* 175, no. 3 (March 2010): 188-93.

⁷⁶ Dr. Curtis Gilroy, Director for Accession Policy, Office of the Under Secretary of Defense for Personnel & Readiness, *Recruiting, Retention, and End Strength Overview before the House Armed Services Personnel Subcommittee*, 109th Cong., 1st sess., March 3, 2009, 2.

⁷⁷ Ibid.

⁷⁸ Ibid.

⁷⁹ “Calorie Consumption on the Rise in the United States, Particularly Among Women,” February 5, 2004, linked from the Center for Disease Control Homepage, <http://www.cdc.gov/nchs/pressroom/04news/calorie.htm> (accessed January 29, 2013).

⁸⁰ United States Department of Agriculture, “Agriculture Fact Book 2001-2001,” <http://www.usda.gov/factbook/chapter2.htm> (accessed January 29, 2013).

⁸¹ Center for Disease Control Physical Activity Statistics, <http://apps.nccd.cdc.gov/PASurveillance/stateSumV.asp?year=2007> (accessed January 29, 2013).

⁸² Ogden, Cynthia L. et al, “Mean Body Weight, Height, and Body Mass Index, United States 1960-2002.” *Advanced Data from Vital Health and Statistics* no. 347, October 27, 2004, <http://www.cdc.gov/nchs/data/ad/ad347.pdf> (accessed 29 January 2013).

⁸³ Elizabeth Mendes, “In U.S., Self-Reported Weight Up Nearly 20 Pounds Since 1990.” November 23, 2011, linked from the Gallup Homepage, <http://www.gallup.com/poll/150947/Self-Reported-Weight-Nearly-Pounds-1990.aspx> (accessed 29 January, 2013).

⁸⁴ Data obtained from U.S. Census Bureau at <http://www.census.gov/2010census/data/> (accessed January 2013).

⁸⁵ Calculations utilized the United States Department of Agriculture calorie data sheets, <http://www.nal.usda.gov/fnic/foodcomp/Data/SR17/wtrank/sr17a208.pdf> (accessed January 29, 2013).

⁸⁶ United States Department of Agriculture, “Agriculture Fact Book 2001-2001.”

⁸⁷ United States Department of Agriculture, “Agriculture Fact Book 2001-2001.”

⁸⁸ Ibid.

⁸⁹ Ibid.

⁹⁰ Food and Agriculture Organization of the United Nations, “FAOSTAT Country Profile, United States of America,” http://faostat.fao.org/CountryProfiles/Country_Profile/Direct.aspx?lang=en&area=231 (accessed January 29, 2013).

⁹¹ Food and Agriculture Organization of the United Nations, linked from homepage to multiple Country Profiles, and selecting approximately the high end of available calories. <http://www.fao.org/countryprofiles/selectcountry/en/> (accessed January 29, 2013).

⁹² Data from the USDA Economic Research Service <http://www.ers.usda.gov/data-products/major-land-uses.aspx> (accessed January 29, 2013).

⁹³ Ibid.

⁹⁴ Data from the USDA Economic Research Service, <http://www.ers.usda.gov/data-products/livestock-meat-domestic-data.aspx#26056> (accessed January 18, 2013).

⁹⁵ Data from the USDA Economic Research Service, <http://www.ers.usda.gov/data-products/livestock-meat-international-trade-data.aspx#26019> (accessed January 18, 2013).

⁹⁶ Environmental Protection Agency, "Sources of Greenhouse Gas Emissions," <http://www.epa.gov/climatechange/ghgemissions/sources/agriculture.html> (accessed January 28, 2013).

⁹⁷ Ibid.

⁹⁸ Calculated utilizing data from the 2009 National Household Travel Survey extraction tool linked from the *National Household Travel Survey homepage* at <http://nhts.ornl.gov/det/Extraction3.aspx> (accessed February 27, 2013).

⁹⁹ McDonald N. C., et al, "U.S. school travel, 2009 an assessment of trends." *Am J Prev Med* 41, no. 2 (August 2011): 146-51.

¹⁰⁰ Center for Disease Control Physical Activity Statistics, <http://apps.nccd.cdc.gov/PASurveillance/stateSumV.asp?year=2007> (accessed January 29, 2013).

¹⁰¹ Environmental Protection Agency, "Sources of Greenhouse Gas Emissions," <http://www.epa.gov/climatechange/ghgemissions/sources/agriculture.html> (accessed January 28, 2013).

¹⁰² Hannon, B. M. and Lohman, T. G., "The energy cost of overweight in the United States." *Am J Public Health* 68, no. 8 (August 1978): 765-7.

¹⁰³ Based on an estimated US population of 222,584,545 in 1978 as published by the US Bureau of the Census at <http://www.census.gov/popest/data/national/totals/pre-1980/tables/popclockest.txt> (accessed February 24, 2013).

¹⁰⁴ US Global Change Research Program, "National Climate Assessment-Draft Report," January 11, 2013, <http://ncadac.globalchange.gov/> (accessed January 29, 2013).

¹⁰⁵ Paul R. Ehrlich and Jianguo Liu, "Socioeconomic and Demographic Roots of Terrorism," in *Making of a Terrorist, vol 3, Recruitment, Training and Root Causes*, ed. James J. F. Forest (Westport, CT: Praeger Publishers, 2005) *Praeger Security*

International Online

<<http://psi.praeger.com/doc.aspx?d=/books/greenwood/C8546/C8546-786.xml>>
(accessed 29 January, 2013).

¹⁰⁶ Susan Lang, "World neglect of hunger is 'immoral and appalling', feeds terrorism, says Cornell Expert," February 17th, 2006 linked from Cornell Chronical Online, <http://www.news.cornell.edu/stories/Feb06/AAAS.hunger.nochange.ssl.html> (accessed February 21, 2013).

¹⁰⁷ Karin von Hippel, "Dealing with the Roots of Terror," in *Making of a Terrorist, vol 3, Recruitment, Training and Root Causes*, ed. James J. F. Forest (Westport, CT: Praeger Publishers, 2005) *Praeger Security International Online* <<http://psi.praeger.com/doc.aspx?d=/books/greenwood/C8546/C8546-786.xml>> (accessed 29 January, 2013).

¹⁰⁸ Sheftick, Gary, "General Casey: Trends Must be Reversed to Stop Terrorist Recruiting." *Pentagon Brief*, January 1, 2008: 2-3, <http://search.proquest.com.ezproxy.usawcpubs.org/docview/215561671/abstract?accountid=4444> (accessed September 27, 2012).

¹⁰⁹ Ibid.

¹¹⁰ National Intelligence Council, "*Global Trends 2030: Alternative Worlds*" December, 2012, Linked from the National Intelligence homepage at <http://www.dni.gov/index.php/about/organization/national-intelligence-council-global-trends> (accessed April 22, 2013): 59.

¹¹¹ Ibid., 30.

¹¹² Ibid., 61.

¹¹³ Shamseddeen, "Epidemiology and Economic Impact of Obesity and Type 2 Diabetes," 1163-72.

¹¹⁴ Ibid.

¹¹⁵ Bischoff, SC, et al. "Multicenter evaluation of an interdisciplinary 52-week weight loss program for obesity with regard to body weight, comorbidities and quality of life-a prospective study." *Int J Obes (London)* 36, no. 4 (April 2012): 614-24.

¹¹⁶ Dall, Timothy, "Cost Associated With Being Overweight and With Obesity."; Williamson, David F., et al, "Prospective Study of Intentional Weight Loss and Mortality in Overweight White Men Aged 40-64 Years." *American Journal of Epidemiology* 149, no. 6 (March 1999): 491-503; Caterson, I.D., et al, "Maintained intentional weight loss reduces cardiovascular outcomes: results from the Sibutramine Cardiovascular OUTcomes (SCOUT) trial." *Diabetes, Obesity and Metabolism* 14, no. 6 (June 2012): 523-530; Aucott, Lorna S., "Influences of weight loss on long-term diabetes outcomes."

Proceedings of the Nutrition Society 67, no. 1 (2008) 54-59; Birks, S., et al. "A systematic review of the impact of weight loss on cancer incidence and mortality." *Obesity Review* 13, no. 10 (October 2012) 869-91; Stevens, V.L., et al, "Weight cycling and mortality in a large prospective US study." *American Journal of Epidemiology* 175, no. 8 (April 2012): 785-92; Shea, M.K., et al, "The effect of intentional weight loss on all-cause mortality in older adults: results of a randomized controlled weight-loss trial." *Am J Clin Nutr* 94, no. 3 (September 2011): 839-46; Shea, M. K., et al, "The effect of randomization to weight loss on total mortality in older overweight and obese adults: the ADAPT Study." *J Gerontol A Biol Sci Med Sci* 65, no. 5 (May 2010): 519-25; Harrington, M., et al, "A review and meta-analysis of the effect of weight loss on all-cause mortality risk." *Nutr Res Rev* 22, no.1 (June 2009): 93-108; Simonsen, M. K., et al, "Intentional weight loss and mortality among initially healthy men and women." *Nutr Rev* 66, no. 7 (July 2008): 375-86.

¹¹⁷ Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-25.

¹¹⁸ Yoon, Jean, et al., "Recent Trends in Veterans Affairs Chronic Condition Spending," 293-8.

¹¹⁹ 2005 dollars were converted to 2008 equivalent and then comparison made utilizing factors found at <http://oregonstate.edu/cia/polisci/faculty-research/sahr/cv2008rsx1.pdf> (accessed February 5, 2013).

¹²⁰ Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-25.

¹²¹ Calculations made using the USDA data calorie data sheet: <http://www.nal.usda.gov/fnic/foodcomp/Data/SR17/wtrank/sr17a208.pdf>

¹²² Ormond, Barbara A., et al, "Potential National and State Medical Care Savings From Primary Disease Prevention." *American Journal of Public Health* 101, no. 1 (January 2011): 157-164.

¹²³ Calculated utilizing 2008 cost of care presented by Yoon, et al for stroke, hypertension, diabetes and heart conditions multiplies by 0.05.

¹²⁴ Wang L. Y., et al, "Long-term health and economic impact of preventing and reducing overweight and obesity in adolescence." *J Adolesc Health* 46, no. 5 (May 2010): 467-73.

¹²⁵ Wang, "Health and Economic Burden of the Projected Obesity Trends in the USA and the UK," 815-25.

¹²⁶ Estimated utilizing the cost per patient data from Yoon, et al multiplied by potential number of patients prevented presented by Wang, et al.

¹²⁷ United States Department of Agriculture, "Agriculture Fact Book 2001-2001."

¹²⁸ Based on EPA estimate of agricultural sector production of 432.3 million metric tons of greenhouse gases in 2007 vs. total agricultural acreage in 2007.

¹²⁹ United States Department of State, *U.S. Climate Action Report 2010*. (Washington: Global Publishing Services) June 2010.

¹³⁰ Based on 408 million acres of agricultural land.

¹³¹ Environmental Protection Agency, "*Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2010*." April 15, 2012, Linked from the *EPA Homepage* at <http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-Main-Text.pdf> (accessed February 21, 2013).

¹³² Comparison based on 2007 total acres allocated to agriculture vs. total greenhouse gas emission estimates from the EPA. Of note emissions have remained relatively constant through 2010 with total estimates of 428 million metric tons.

¹³³ National Intelligence Council, "*Global Trends*," 30.

¹³⁴ USDA Economic Research Service "Countries and Regions Overview," <http://www.ers.usda.gov/topics/international-markets-trade/countries-regions.aspx> (accessed February 20, 2013); National Intelligence Council, "*Global Trends*," 33..

¹³⁵ Data from the USDA Economic Research Service <http://www.ers.usda.gov/data-products/wheat-data.aspx> (accessed January 29, 2013).

¹³⁶ Data from the USDA Economic Research Service <http://www.ers.usda.gov/data-products/rice-yearbook-2012.aspx> (accessed January 29, 2013).

¹³⁷ Data from the USDA Economic Research Service <http://www.ers.usda.gov/data-products/wheat-data.aspx> (accessed January 29, 2013).

¹³⁸ Data from the USDA Economic Research Service <http://www.ers.usda.gov/data-products/rice-yearbook-2012.aspx> (accessed January 29, 2013).

¹³⁹ National Intelligence Council, "*Global Trends*," 61.

¹⁴⁰ Sheftick, Gary, "General Casey: Trends Must be Reversed to Stop Terrorist Recruiting."

¹⁴¹ National Intelligence Council, "*Global Trend*," 61.

¹⁴² Karin von Hippel, "Dealing with the Roots of Terror."

¹⁴³ Center for Disease Control
http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html#Interpreted
(accessed September 29, 2012).

¹⁴⁴ Centers for Disease Control <http://www.cdc.gov/obesity/adult/defining.html>
(accessed September 29, 2012).

¹⁴⁵ U.S. Department of the Army, *The Army Weight Control Program*, Army Regulation 600-9 (Washington, DC: U.S. Department of the Army, November 27, 2006), 4.

¹⁴⁶ Hall, Kevin D., et al, "Quantification of the effect of energy imbalance on bodyweight." *The Lancet* 378, no.9793 (August 27, 2011): 826-37.

¹⁴⁷ Google websearch performed January 29, 2013.

¹⁴⁸ "Losing Weight," linked from the American Heart Association homepage, http://www.heart.org/HEARTORG/GettingHealthy/WeightManagement/LosingWeight/Losing-Weight_UCM_307904_Article.jsp Accessed 10 February, 2013).

¹⁴⁹ Hall, "Quantification of the effect of energy imbalance on bodyweight," 826-37.

¹⁵⁰ Ibid.

¹⁵¹ Hall, "Quantification of the effect of energy imbalance on bodyweight," 826-37; Forbes, Gilbert B., "Lean Body Mass-Body Fat Interrelationships in Humans." *Nutrition Reviews* 45, no. 8 (August 1987): 225-31; Hall, Kevin D., "Predicting metabolic adaptation, body weight change and energy intake in humans." *Am J Physiol Endocrinol Metab* 298 no. 3 (March 2010) 449-466; Hall, K. D., et al, "How adaptations of substrate utilization regulate body composition." *Int J Obes (London)* 31, no. 9 (September 2007): 1378-83.

¹⁵² Forbes, Gilbert B., "Lean Body Mass-Body Fat Interrelationships in Humans," 225-31; Hall, Kevin D. and Jordan, Peter N., "Modeling weight-loss maintenance to help prevent body weight regain." *Am J Clin Nutr* 88, no. 6 (December 2008): 1495-1503; Hall, Kevin, "Body Fat and Fat-Free Mass Interrelationships." *Br J Nutr* 97, no. 6 (June 2007):1059-63.

¹⁵³ Hall, Kevin D., "Quantification of the effect of energy imbalance on bodyweight," 826-37.

¹⁵⁴ Ibid.

¹⁵⁵ Hemmingsson, E., et al. "Weight loss and dropout during a commercial weight-loss program." *American Journal of Clinical Nutrition* 96, no. 5 (November 2012): 953-6; Kong, W. et al., "Predictors of success to weight-loss intervention." *Diabetes Res Clin Pract* 90, no 2 (November 2010): 147-53.

¹⁵⁶ Hemmingsson "Weight loss and dropout during a commercial weight-loss program," 953-61; Kong, "Predictors of success to weight-loss intervention," 147-53; Richdeep, Gill S., "Predictors of attrition in a multidisciplinary adult weight management clinic." *Can J Surg* 55, no. 4 (August 2012): 239-43.

¹⁵⁷ Accession Medical Standards Analysis and Research Activity home page, <http://www.amsara.amedd.army.mil/Default.aspx> (accessed 28 January, 2013).

¹⁵⁸ U.S. Department of the Army, *The Army Weight Control Program*, Army Regulation 600-9 (Washington, DC: U.S. Department of the Army, November 27, 2006), 3-12.

¹⁵⁹ U.S. Department of the Army, *Army Physical Readiness Training*, Army Field Manual 7-22 (Washington, DC: U.S. Department of the Army, October 26, 2006), 6-2.

¹⁶⁰ Christensen, J.R., et al, "Weight loss among female health care workers-a 1 year workplace based randomized controlled trial in the FINALE-health study." *BMC Public Health* 8, no. 12 (August 2012): 625; Morgan, P. J., et al, "The impact of a workplace-based weight loss program on work-related outcomes in overweight male shift workers." *J Occup Environ Med* 54, no. 2 (February 2012): 122-7.

¹⁶¹ Peters, S., et al, "Medical undergraduates' use of behavior change talk: the example of facilitating weight management." *BMC Med Educ* 13, no. 1 (January 2013): 7; Christensen, "Weight loss among female health care workers," 625; Wadden, T. A., et al, "A two-year randomized trial of obesity treatment in primary care practice." *N Engl J Med* 365, no. 21 (November 24, 2011): 1969-79; Bischoff, S. C., et al, "Multicenter evaluation of an interdisciplinary 52-week weight loss program for obesity with regard to body weight, comorbidities and quality of life-a prospective study." *Int J Obes (London)* 36, no. 4 (April 2012): 614-24.

¹⁶² U.S. Department of the Army. *Army Physical Readiness Training*. Army Field Manual 7-22 Washington, DC: U.S. Department of the Army, October 26, 2012.

¹⁶³ Timmerman, G. M. and Brown, A., "The effect of a mindful restaurant eating intervention on weight management in women." *J Nutr Educ Behav* 44, no. 1 (January-February 2012): 22-8; Whetstone, L. M., et al. "Effects of a behavior-based weight management program delivered through a state cooperative extension and local public health department network, North Carolina, 2008-2009." *Prev Chronic Dis* 8, no. 4 (July 2011): 81; Dalen, J., et al, "Pilot study: Mindful Eating and Living (MEAL): weight, eating behavior, and psychological outcomes associated with a mindfulness-based intervention for people with obesity." *Complement Ther Med* 18, no. 6 (December 2010): 260-4; Miller, C. K., et al, "Comparative effectiveness of a mindful eating intervention to a diabetes self-management intervention among adults with type 2 diabetes: a pilot study." *J Acad Nutr Diet* 112, no. 11 (November 2012): 1835-42; Mockus, D. S., et al, "Dietary self-monitoring and its impact on weight loss in overweight children." *Int J Pediatr Obes* 6, no. 3-4 (August 2011): 197-205; Linde, J. A., et al, "Self-

weighing in weight gain prevention and weight loss trials." *Ann Behav Med* 30, no. 3 (December 2005): 210-6; Feuerstein, M., et al, "The weight loss profile: a biopsychosocial approach to weight loss." *Int J Psychiatry Med* 19, no. 2 (1989): 181-92.

¹⁶⁴ Kenneth R. Jones, "MOVE!, Tips for Patient Care," briefing slides with scripted commentary, Department of Veterans Affairs, Washington, DC October 23, 2012.

¹⁶⁵ Ogden, J. and Evans, C., "The problem with weighing: effects on mood, self-esteem and body image." *Int J Obes Relat Metab Disord* 20, no. 3 (March 1996): 272-7.

¹⁶⁶ Mockus, "Dietary self-monitoring," 197-205; Lind, "Self-weighing in weight gain prevention," 210-6.

¹⁶⁷ Feuerstien, "The weight loss profile," 181-92; Wieland, L. S., et al, "Interactive computer-based interventions for weigh loss or weight maintenance in overweight or obese people." *Cochrane Database Syst Rev* 15, no. 8 (August 2012); Wadden, "A two-year randomized trial of obesity treatment," 1969-79.

¹⁶⁸ Ibid.

¹⁶⁹ Shrestha, M., et al, "Effects of an accelerometer on body weight and fitness in overweight and obese active duty soldiers." *Military Medicine* 178, no. 1 (January 2013) 82-7.

¹⁷⁰ Lally, P., et al, "Healthy habits: efficacy of simple advice on weight control based on a habit-formation model." *Int J Obes* 32, no. 4 (April 2008): 700-7.

¹⁷¹ Ibid.

¹⁷² Jones, "MOVE!, Tips for Patient Care."

¹⁷³ Individuals may belong to more than one group; therefore total will be greater than 100%.

¹⁷⁴ Jones, "MOVE!, Tips for Patient Care."

¹⁷⁵ Warner, Christopher H., et al, "Military Family Physician Attitudes toward Treating Obesity." *Military Medicine* 173, no. 10 (October 2008): 978-984.

¹⁷⁶ Mashiero, Rika, et al, "Report VIII: contemporary issues in medicine: the prevention and treatment of overweight and obesity. Medical School Objectives Project," Association of American Medical Colleges August, 2007 (Washington, DC), 8. "ACGME Program Requirements for Graduate Medical Education in Family Medicine." July 1, 2007, Linked from the *American College of Graduate Medical Education homepage* at

<http://www.acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/120pr07012007.pdf> (accessed April 22, 2013). "ACGME Program Requirements for Graduate Medical Education in Internal Medicine." July 1, 2009, Linked from the *American College of Graduate Medical Education homepage* at <http://www.acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/120pr07012007.pdf> (accessed April 22, 2013).

¹⁷⁷ Dall, "Cost Associated with Being Overweight," 491-503; Williamson, "A Prospective Study of Intentional Weight Loss and mortality in never-smoking overweight US white women aged 40-64." *Am J Epidemiol* 142, no. 3 (August 1995) 369; Caterson, "Maintained intentional weight loss," 523-30; Aucott, "Influences of weight loss on long-term diabetes outcomes," 54-9; Birks, "A Systematic review of the impact of weight loss," 869-91; Stevens, "Weight cycling and mortality," 785-92; Shea, "The effect of intentional weight loss on all-cause mortality," 839-46; Shea, "The effect of randomization to weight loss on total mortality," 519-25; Harrington, "A review and meta-analysis of the effect of weight loss," 93-108; Simonsen, "Intentional weight loss and mortality," 375-86; Wang, "Health and economic burden of the projected obesity trends in the USA and UK," 815-25; Moriarty, "The effects of Incremental costs of Smoking and Obesity," 286-91; Samseddeen, "Epidemiology and Economic Impact of Obesity," 1163-72.

¹⁷⁸ LTG Patricia Horoho, US Army Surgeon General "US Army Medical Command Commanders Conference," briefing slides with oral commentary, Washington, DC, July 2013. Confirmed via direct correspondence.

¹⁷⁹ LTG Patricia Horoho, US Army Surgeon General "US Army Medical Command Commanders Conference, Opening Remarks," briefing slides with oral commentary, Headquarters, MEDCOM, Washington, DC February 12, 2013.

¹⁸⁰ Ibid.

¹⁸¹ LTC Daniel Johnston, Medical Director, Comprehensive Soldier and Family Fitness, "US Army Medical Command Commanders Conference, CSF2 Fitness Platform," briefing slides with oral commentary, Headquarters, MEDCOM, Washington, DC February 12, 2013.

¹⁸² Ibid.

¹⁸³ Implementation guidance can be found at the US Army Quartermaster website at http://www.quartermaster.army.mil/jccoe/Operations_Directorate/QUAD/Nutrition/Implementation_Guide.pdf (accessed February 22 2013).

¹⁸⁴ Lally, "healthy Habits," 700-7.

¹⁸⁵ U.S. Department of the Army. *Army Physical Readiness Training*.

¹⁸⁶ Bingham, C. M., et al, "Effects of a healthy food supply intervention in a military setting: positive changes in cereal, fat and sugar containing foods." *In J Behav Nutr Phys Act* 9, no. 91(July 31, 2012) <http://www.ijbnpa.org/content/9/1/91> (accessed February 21, 2013).

¹⁸⁷ United States Department of Agriculture, "Agriculture Fact Book 2001-2001."

¹⁸⁸ Farley, Thomas A., "The Role of Government in Preventing Excess Calorie Consumption." *JAMA* 308, no. 11 (September 2012): 1093-4.

¹⁸⁹ Dowray, Suniana, et al, "Potential effect of physical activity based menu labels on the calorie content of selected fast food meals," *Appetite* 62, *Marketing to Children - Implications for Eating Behaviour and Obesity: A special issue with the UK Association for the Study of Obesity* (March 1, 2013): 173-181

¹⁹⁰ Bleich, Sara N, et al, "Reduction in Purchases of Sugar-Sweetened Beverages Among Low-Income Black Adolescents After Exposure to Caloric Information," *American Journal of Public Health* 101, no. 2 (February 2012): 329-335.

¹⁹¹ Hall, "Quantification of the effect of energy imbalance," 826-37; Forbes, "Lean Body Mass-Body Fat Interrelationships," 225-31; Hall, "Body Fat and Fat-Free Mass Interrelationships," 1059-63; Hall, "Predicting metabolic adaptation," 449-66; Hall, "How adaptations of substrate utilization regulate body composition," 1378-83.

¹⁹² Mockus, "Dietary self monitoring," 197-205; Linde, "Self-weighing in weight gain prevention," 210-6.

¹⁹³ LTC Tim Pendergrass, "US Army Medical Command Commanders Conference, Injury Prevention/Human Performance Optimization and Military Power, Performance & Prevention Update," briefing slides with oral commentary, Headquarters, MEDCOM, Washington, DC February 12, 2013.

¹⁹⁴ Ibid.

¹⁹⁵ Ibid.

¹⁹⁶ Ibid.

¹⁹⁷ Ibid.

¹⁹⁸ US Healthier School Challenge Homepage <http://www.fns.usda.gov/tn/HealthierUS/index.html> (accessed 16 February, 2013).

¹⁹⁹ Let's Move Program Homepage <http://www.letsmove.gov/> (accessed 16 February, 2013).

²⁰⁰ Max Fischer, "How Japan's revolutionary school lunches helped slow the rise of child obesity," January 28, 2013, <http://www.washingtonpost.com/blogs/worldviews/wp/2013/01/28/how-japans-revolutionary-school-lunches-helped-slow-the-rise-of-child-obesity/html> (accessed February 16, 2013).

²⁰¹ Park, S., et al, "The impact of the availability of school vending machines on eating behavior during lunch: the Youth Physical Activity and Nutrition Survey." *J Am Diet Assoc* 110, no. 10 (October 2010): 1532-6 examined the likelihood of eating from vending machine vs. school lunch.

²⁰² Dan Glickman, former Secretary of Agriculture "Lower Calorie Foods: It's Just Good Business," briefing slides with oral commentary, Hudson Institute, Washington, DC February 7, 2013.

²⁰³ "Wal-mart Launches Major Initiative to Make Food Healthier and Healthier Food More Affordable," January 20, 2011, linked from *Wal-Mart homepage* at "News and Views," <http://news.walmart.com/news-archive/2011/01/20/walmart-launches-major-initiative-to-make-food-healthier-healthier-food-more-affordable>.

²⁰⁴ Frank, L. D., et al, "Stepping towards causation: do built environments or neighborhood and travel preferences explain physical activity, driving and obesity?" *Soc Sci Med* 65, no. 9 (November 2007): 1898-914; Lopez-Zetina, J. et al, "The link between obesity and the built environment. Evidence from an ecological analysis of obesity and vehicle miles of travel in California." *Health Place* 12, No. 4 (December 2006): 656-64; Frank, L. D., et al, "Obesity relationships with community design, physical activity, and time spent in cars." *Am J Prev Med* 27, no. 2 (August 2004): 87-96.

²⁰⁵ Christensen, "Weight loss among female health care workers," 625 Morgan, "The impact of a workplace-based weight loss program," 122-7.

²⁰⁶ U.S. Department of Health and Human Services, *The Surgeon General's Call to Action to Support Breastfeeding*. (Washington, DC: Office of the Surgeon General., January, 20, 2011), 1.

²⁰⁷ Bartick, M. and Reinhold, A., "The Burden of Suboptimal Breastfeeding in the United States: A Pediatric Cost Analysis." *Pediatrics* 125, no. 5 (May 2010): 1048-56.

²⁰⁸ Healthier Hospitals Initiative, <http://healthierhospitals.org/hhi-challenges/healthier-food> (accessed February 11, 2013).

²⁰⁹ Guy Clifton, *Flatlined: Resuscitating American Medicine* (New Brunswick: Rutgers University Press, 2009) 57-138.

²¹⁰ Madison Park, "Rick Warren and church tackle obesity," January 24, 2012, linked from the CNN homepage at "Health,"

<http://www.cnn.com/2012/01/24/health/saddleback-warren-diet/index.html> (accessed February 20, 2013).

²¹¹ Kimberly A Strassel, "Mr. Burd Goes to Washington," June 19, 2009 linked from the Wall Street Journal homepage at "Opinion," <http://online.wsj.com/article/SB124536722522229323.html> (accessed April 4, 2013).

²¹² Ibid.

²¹³ Hall, "Quantification of the effect of energy imbalance on bodyweight," 826-37; Forbes, "Lean body mass-body fat interrelationships," 225-31.

²¹⁴ Ibid.

²¹⁵ Personal conversation with Dr. Tracy Gaudet, Director of Patient Centered Care and Cultural Transformation on December 20, 2012.

²¹⁶ LTG Patricia Horoho, US Army Surgeon General "Healthcare to Health," briefing slides with oral commentary, presented at the Military Health System Conference, Washington, DC January 19, 2012.

²¹⁷ Clifton, *Flatlined: Resuscitating American Medicine*, 57-138.

²¹⁸ National Committee for Quality Assurance, "HEDIS and Performance Measurement," linked from the NCQA homepage, "HEDIS and Performance Measurement," <http://www.ncqa.org/tabid/59/Default.aspx> (accessed February 20, 2013).

²¹⁹ DC Healthy Schools Program, <http://dchealthyschools.org/> (accessed February 20, 2013).

²²⁰ Clifton, *Flatlined: Resuscitating American Medicine*, 232-342.

²²¹ Mashiero, Rika, et al, "Report VIII: contemporary issues in medicine." 8.

²²² Farley, "The Role of Government in Preventing Excess Calorie Consumption," 1093-4.

²²³ Ibid.

²²⁴ Christensen, "Weight loss among female health care workers," 625; Morgan, P. J., "The impact of a workplace-based weight loss program," 122-7.

²²⁵ Henry Cardello, Senior Fellow, Judson Institute Obesity Solutions Initiative, "Lower Calorie Foods: It's Just Good Business," briefing slides with oral commentary, Hudson Institute, Washington, DC February 7, 2013.

²²⁶ Ibid.

²²⁷ Linked from the *Partnership for a Healthier America Homepage*, "Our Partners," <http://ahealthieramerica.org/our-partners/all-partners/#133,partners> (accessed February 20, 2013).

²²⁸ Mary Clare Jalonick, "Menu Labeling Law: Calorie Counts are a 'Thorny' Issue, FDA Head Says," March 13, 2013, linked from the Huffington Post homepage at "Healthy Living," http://www.huffingtonpost.com/2013/03/12/menu-labeling-law-calorie-counts-fda_n_2860331.html (accessed April 4, 2013).

²²⁹ Ellison, B., et al, "Looking at the label and beyond: the effects of calorie labels, health consciousness, and demographics on caloric intake in restaurants." *Int J Behav nutr Phys Act* 10, no. 1 (February 8, 2013): 21; Roberto, C. A., et al, "Evaluating the impact of menu labeling on food choices and intake." *Am J Public Health* 100, no. 2 (February 2010): 312-8.

²³⁰ Farley, "The Role of Government in Preventing Excess Calorie Consumption," 1093-4.

²³¹ Wang, Claire, et al, "A Penny-Per-Ounce Tax on Sugar Sweetened Beverages Would Cut Health And Cost Burdens of Diabetes." *Health Affairs* 31, no. 1 (January 2012): 199-207; Brownell, K.D., et al, "Ounces of prevention-the public policy case for taxes on sugared beverages." *N Engl J Med* 360, no. 18 (April 30, 2009): 1805-8.

²³² Wang, "A Penny-Per-Ounce Tax," 199-207.

²³³ Ibid.

²³⁴ Dan Glickman, former Secretary of Agriculture "Lower Calorie Foods: It's Just Good Business," briefing slides with oral commentary, Hudson Institute, Washington, DC February 7, 2013.

²³⁵ Ibid.

²³⁶ Frank, "Stepping towards causation," 1898-914; Lopez-Zetina, "The link between obesity and the built environment," 656-64; Frank, "Obesity relationships with community design," 87-96.

²³⁷ Heymand, Eric and Goldsmith, David, "Best approaches in the battle against Globesity? Learning lessons from our experience tackling HIV-AIDs and tobacco smoking." *J R Soc Med Sh Rep* 3, no. 7:45 (July 2012) available at <http://shortreports.rsmjournals.com/content/3/7/45.full> (accessed December 19, 2012).

²³⁸ Ibid.